2008 Performance Report

General Chemistry and Microbiology Section

May, 2009

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Ontario

2008 PERFORMANCE REPORT

GENERAL CHEMISTRY AND MICROBIOLOGY SECTION

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Laboratory Services Branch

Ontario Ministry of the Environment

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INTRODUCTION

The General Chemistry and Microbiology Section (GCMS) is part of the Ministry of the Environment's Laboratory Services Branch. The section is comprised of two units, the Water Chemistry and Microbiology Unit. The Water Chemistry Unit identifies and provides quantitative analysis for major ions, nutrients, and physical properties in a variety of matrices. The Microbiology Unit identifies and enumerates indicator bacteria of water and waste waters.

This report provides a brief outline of the analytical quality control (QC) program associated with sample analysis and examines 2008 performance data for each test in the Water Chemistry and Microbiology Units. GCMS strives to maintain a high standard of analytical performance through its quality assurance program. QC is an integral part of this process.

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1.0 PERFORMANCE REPORT FORMAT

The parameters are those analysed by the GCMS for 2008.

The performance report is organized alphabetically according to test name (eg. Dissolved Organic Carbon is filed under the heading "Carbon, Dissolved Organic") and second, by the method reference number. Detailed information concerning the format of each page is outlined below:

1.1 TEST DESCRIPTION

TITLE: The name of the test parameter

ACCREDITATION & DRINKING WATER LICENSING STATUS:

Accreditation Status:	Identifies if the parameter is accredited
Licensed (Drinking Water):	Identifies if the parameter is licensed under the Ontario Safe Drinking Water Regulation O.Reg.248/03
Reportable Limit:	Identifies the reportable limit associated with the Ontario Safe Drinking Water Regulation O.Reg169/03

Refer to LSBSOP.031 & LSBSOP.039 for further explanation on the procedure for drinking water analysis

IDENTIFICATION:

Laboratory:	Location where the test is performed.
Method Reference No:	A number assigned by the Quality Management Unit to an analytical test method eg. (E3370).
Product Code:	LIMS code for analysis request.
Sample Type/Matrix:	The various sample types that can be routed to the method.
Method Introduced:	Date that the method was implemented at the laboratory.
Reporting Units:	Unit of measurement in which the results are reported.
Supervisor/Scientist:	Name of supervisor/scientist responsible for the method.

SAMPLING:
The type of container and preservative (if applicable) that is used and minimum volume of sample that is usually required. Any sample preparation that is normally performed in the field, is also indicated [(1)].

SAMPLE PREPARATION (OPTIONAL):
Sample preparation techniques which are usually performed at the laboratory, before analysis.

ANALYTICAL PROCEDURE:
Brief summary of the analytical method used to determine the parameter.

INSTRUMENTATION:
Type of instrumentation used to perform the test. Examples: Automated continuous flow systems consist of a sampler, peristaltic pump, manifold for reagent addition, detection system and readout system. Personal computers are used to control the operation of analytical equipment and/or data acquisition.

REPORTING:
W and T are method attributes that can be used to qualify low level data[(4)]. A value reported with the qualifier <=W indicates no measurable response was observed under the conditions of the test and the value accompanying the remark is the lowest reportable value of the method. A value reported as <T is interpreted as a measurable trace amount of the constituent, but under the conditions of the test are not satisfactorily verifiable. Interpret data with caution. When dilutions are required, WE and TE are used as data qualifiers to indicate that the smallest measurable amount (W) and the limit of reliability (T) respectively have increased proportionately to the level of dilution.

The GCMS calculates **W**, the minimum reporting value by rounding down the (standard deviation of duplicates (S_2), near zero) to nearest 1,2 or 5 digit[(4)]. **T** is the method detection limit and is five times W. The latest calculations, valid at the date of publication for W and T values of all active methods, are contained in this report (APPENDIX A).

CALIBRATION:
The number of standards used to calibrate the analytical system plus blanks if applicable.

CONTROLS:
The calibration, drift, recovery, certified reference material and interference controls that are used when applicable to ensure that the system is operating properly.

MODIFICATIONS:
Modifications made to the test in 2008.

NOTES:
Explanatory notes which may aid the data user in interpreting results and information.

1.2 PERFORMANCE DATA SUMMARY

QUALITY CONTROL DATA FROM/TO: (Optional)
The period of time over which data was collected.

ANALYTICAL RANGE AND REPORTING UNIT:
The full scale value for the analytical range is given in concentration units.

CALIBRATION CONTROL:
Calibration control includes a table outlining the number of data collected over the selected time period, expected concentrations of the control standards, the calculated mean concentration of these standards, mean bias (mean concentration minus the expected concentration), and standard deviations of each control standard. The between run standard deviation (S), the within run standard deviation (S_w), the ratio S/S_w, and the historical control limits for standards sums and differences are provided.

RECOVERIES (Where applicable):
The table outlines the number of data collected over the selected time period, expected concentrations of the recovery standards, the calculated mean concentration of these standards, and standard deviations of each recovery standard.

DUPLICATES:
The table outlines within run duplicate data collected over the selected time period. Data is sorted into a number of concentration spans. The standard deviation for duplicates is provided for each range. The coefficient of variation (%) is determined by dividing the mean standard deviation (S_2) for a particular concentration span by the mean concentration of duplicate results in that span and multiplying by 100.

OTHER CHECKS (Where applicable):
The table outlines the number of data collected over a selected time period, the calculated mean concentration and standard deviation.

1.3 QUALITY CONTROL GRAPHICS

CALIBRATION CONTROL:
Calibration control standards sums and differences are plotted for the period of data collection (referred to on the graphs as "QUALITY CONTROL STANDARD A+B" for example). The vertical scale identifies the warning/control limits expressed on either side of the expected value. These limits were chosen from analytical performance data.

NOTE:

DATE FORMAT:
yyyy/m/d

2.0 ANALYTICAL QUALITY CONTROL PROGRAM

Quality control is a continuous process that involves constant checks of sample processing procedures. This report summarizes the QC data collected during analytical processing to monitor performance of the analytical system.

Calibration Standards are verified for identity, purity and concentration accuracy by comparison against independent sources wherever possible. Usually, a series of calibration standards are analyzed covering the analytical range.

Once a system has been calibrated, quality control begins. Depending on the analytical procedure, quality control may be used to evaluate: calibration, blank, recovery, sensitivity, potential interference, and sample repeatability.

Calibration and Blank

Calibration is controlled by a minimum of two quality control standards and usually a long term blank which are prepared and maintained independently of the calibration standards. The system is not calibrated with the quality control standards. The long term blank is usually the Pure De-ionized Water (Pure-DW) used to prepare the quality control standards and has zero concentration of the target analyte. Control standards are prepared less frequently than calibration standards, thus allowing an independent cross check of the newly prepared calibration standards. When control standards are prepared, they are checked over three consecutive runs where the QC values must be within the warning limits (two standard deviations of theoretical value) before routine use.

The standard deviation of the control standards is used to estimate the between-run standard deviation (S) and is compared against the within-run standard deviation (S_w). If the ratio S/S_w exceeds 1.5 then poor control of systematic error can be inferred[3]. Values for S and S_w are calculated as follows:

$$2S^2 = (S_A)^2 + (S_B)^2 \qquad 2S_w^2 = (S_{A-B})^2$$

Where

S_A = standard deviation (s.d.) of control standard A
S_B = s.d. of control standard B
S_{A-B} = s.d. of the difference between control standards A and B

NOTE: If a second range is employed for a test, more control standards are used because, in many systems, the between-run standard deviations are concentration dependent.

Detailed description of the quality control processes are outlined in several LSB documents (2)(4)(5)(6) and (9).

Control/Warning Limits

The control standards data is assessed and compared against the control/warning limits established from previous data to determine whether the calibration process is in control. The limits are set up initially based on method performance[4], and are reviewed when method and/or performance data reviews are conducted to determine if modifications are required based on historical data calculations. Control limits are calculated for the sums and differences of control standards (A, B, C, D) by the equations:

$(A+B) \pm 4(S_{A-B})$ for the sum of A+B
$(B+C) \pm 4(S_{B-C})$ for the sum of B+C
$(C+D) \pm 4(S_{C-D})$ for the sum of C+D

$(A-B) \pm 3(S_{A-B})$ for the difference of A-B
$(B-C) \pm 3(S_{B-C})$ for the difference of B-C
$(C-D) \pm 3(S_{C-D})$ for the difference of C-D

Note: Warning Limits are calculated by the same formulae above (using ±2 instead of 4 and 3 respectively).

If a control limit is exceeded corrective action is taken.

Recovery

Some methods require sample pre-treatment, such as digestion or extraction. A recovery check, suitable to that method, is required to estimate the efficiency of the pre-treatment. Recovery standards are usually prepared at 0%, 20% and 80% of full scale. The solutions are analysed in the same manner as routine samples. Although these solutions are not used to calibrate the instrument corrections for the blank are calculated and applied if necessary. For an analytical run to be accepted, the recoveries should be within ±3x standard deviation of their expected values, or in some cases long term averages (See Section 1.1 "Reporting" for T determination). The average blank should be within three standard deviations of its historical mean. If a second range is employed for a test, at least one additional recovery standard is used.

Sensitivity and Baseline

Any change in the sensitivity of the instrumentation is monitored periodically during the run, as defined by the method, by analysing a standard that is usually 80% of full scale, and comparing the reading to the original calibration standards. Baseline drift is usually recorded by periodic analysis, as defined by the method, of Pure-DW which does not contain any of the analyte, but may be treated to correspond to sample pre-treatment.

NOTES: QCA and in the case of non-linear calibration response curves QCC, are used to confirm drift sensitivity. ('2008)

Interference

The interference check is run on any test where a substance may be present in concentrations that affect the results. The check is carried out near the threshold concentration of the interfering substance, beyond which the methodological safeguards used to minimize the

interference are no longer effective. The check indicates that the interference has no effect up to the specified concentrations.

Sample Repeatability

Generally, one sample out of twenty is analysed in duplicate up to a maximum of three duplicates per analytical run. The samples are selected for non-adjacent, within-run duplicate analyses. By analysing samples in duplicate, the ability of the analyst to obtain repeatable analytical results, within an analytical run, can be determined. For results to be acceptable, at least two of the three duplicate pairs must conform to limits that are set based on historical performance.

Duplicate data are accumulated and usually sorted into 3 ranges of 0-10 or 0-20, 21-50, 51-100 percent of full scale. More ranges may be added where the analytical scale spans are greater than 2 log scales. When less than 3 data pairs are collected, the remark N.A. (not available) is reported. A standard deviation is calculated for each concentration range. The historical limits are established at 3*S.D. The algorithm differs from the conventional standard deviation as follows

Conventional Std. Dev. (1)*

$$S_1 = \sqrt{\frac{\sum_{i=1}^{n} (\bar{x} - x_i)^2}{n-1}}$$

Within-run Std. Dev of Duplicates (2)*

$$S_2 = \sqrt{\frac{\sum_{i=1}^{n'} (x_1 - x_2)_i^2}{2n'}}$$

* Standard deviations used for the data summaries.

Where S_1 = sample standard deviation
S_2 = duplicate difference standard deviation
N = number of data
$\bar{x}$ = mean of data
x_i = i^{th} result
$(x_1 - x_2)_i$ = difference of the i^{th} duplicate
n' = number of duplicate pairs

The standard deviation (S_2) of the duplicate difference is also expressed as the coefficient of variation (CV).

$$CV = (S^2/V) * 100$$

2.1 PERFORMANCE SUMMARIES

ALKALINITY, TOTAL FIXED ENDPOINT

ACCREDITATION & DRINKING-WATER LICENSING STATUS

ACCREDITED ☑	Licensed (Drinking Water) ☑
	Drinking Water Standard (SDWA): N/A

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	09/07/80
Method Reference No.	E3218	Reporting Unit	mg/L as $CaCO_3$
LIMS Product Code	PHALCO3218	Supervisor	P. Wilson
Sample Type/Matrix	Sludge, Effluent, Industrial Waste, Raw Sewage, Drinking Water, Ground Water, Leachate, Precipitation, Surface Water		

SAMPLING:

Quantity Required	50 mL
Container	Glass or Plastic
Preservative(s)	None

ANALYTICAL PROCEDURE:

Samples (30.0 mL) are titrated with 0.02 N sulphuric acid to pH endpoint of 4.5. The titrant delivery rate is determined from the slope of the titration curve and the stability of the pH reading following each aliquot of titrant.
pH, and conductivity are determined simultaneously.

INSTRUMENTATION:

Automated modular titration system with computer control and data processing software.

REPORTING:

Max. Significant Figures: 3	Current W value: 0.5	Current T value: 2.5	Full Scale: 1000 mg/L

STANDARDIZATION:

Titrant, 0.02N sulphuric acid, is standardized.

CONTROLS:

Standardization and checks	BL plus 4 standards, e.g. QCA, QCB, QCC, QCD
Drift	In run standards throughout the run (tap water diluted to 50% V/V)

Alkalinity, Total Fixed Endpoint (E3218)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 1000.00 mg/L as $CaCO_3$

Calibration Control

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	120	250.00	250.15	0.155	1.850
B	120	100.00	100.36	0.364	0.840
C	120	25.00	25.16	0.157	0.314
D	120	2.50	2.51	0.010	0.147
A + B		350.00	350.52	0.519	2.382
A - B		150.00	149.79	-0.209	1.608
B + C		125.00	125.52	0.520	1.071
B - C		75.00	75.21	0.207	0.680
C + D		27.50	27.67	0.166	0.347
C - D		22.50	22.65	0.147	0.346

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	1.437
	Within Runs	1.137
	Between/Within	1.264
s.d.(BC)	Between Runs	0.634
	Within Runs	0.481
	Between/Within	1.318
s.d.(CD)	Between Runs	0.245
	Within Runs	0.245
	Between/Within	1.000

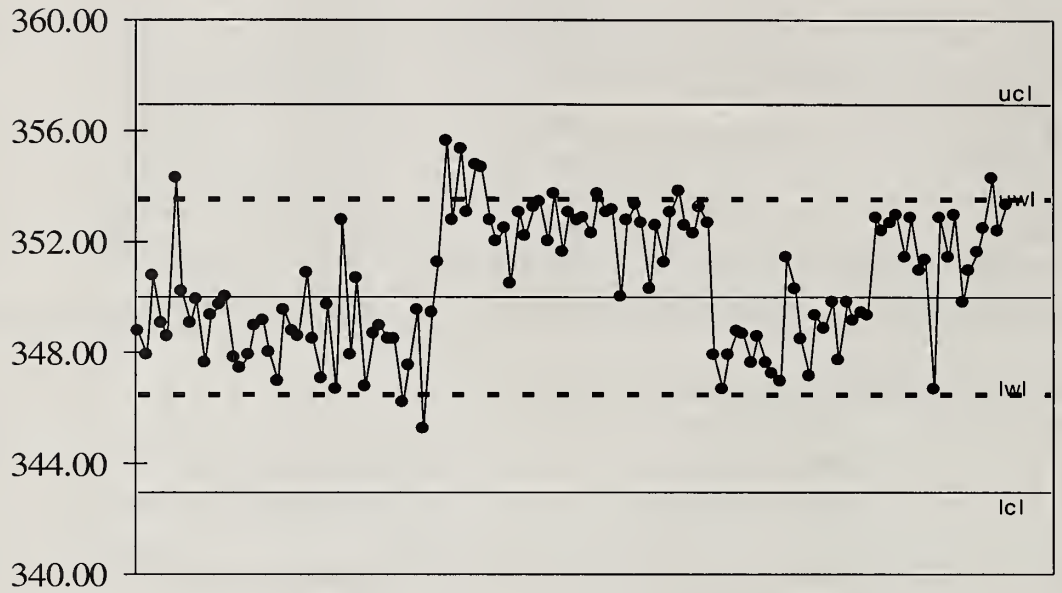
Control Limits

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	353.500	346.500	357.000	343.000
A - B	153.500	146.500	155.250	144.750
B + C	126.750	123.250	128.500	121.500
B - C	76.750	73.250	77.600	72.400
C + D	28.340	26.660	29.180	25.820
C - D	23.340	21.660	23.760	21.240

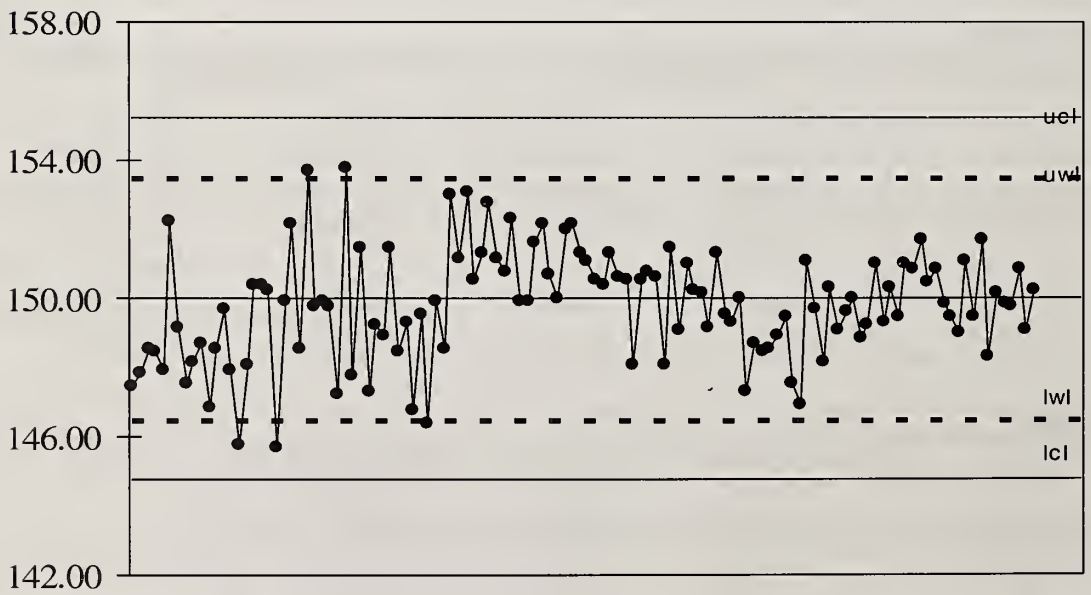
Duplicates

Number	Concentration	Std. Dev.	% Coeff of Var
80	0 - 50	0.277	1.059
110	51 - 100	0.651	0.759
182	101 - 300	1.012	0.518
25	301 - 1000	1.653	0.400
397	Total	0.867	0.608

Alkalinity, Total Fixed Endpoint (E3218)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 1000.00 mg/L as $CaCO_3$

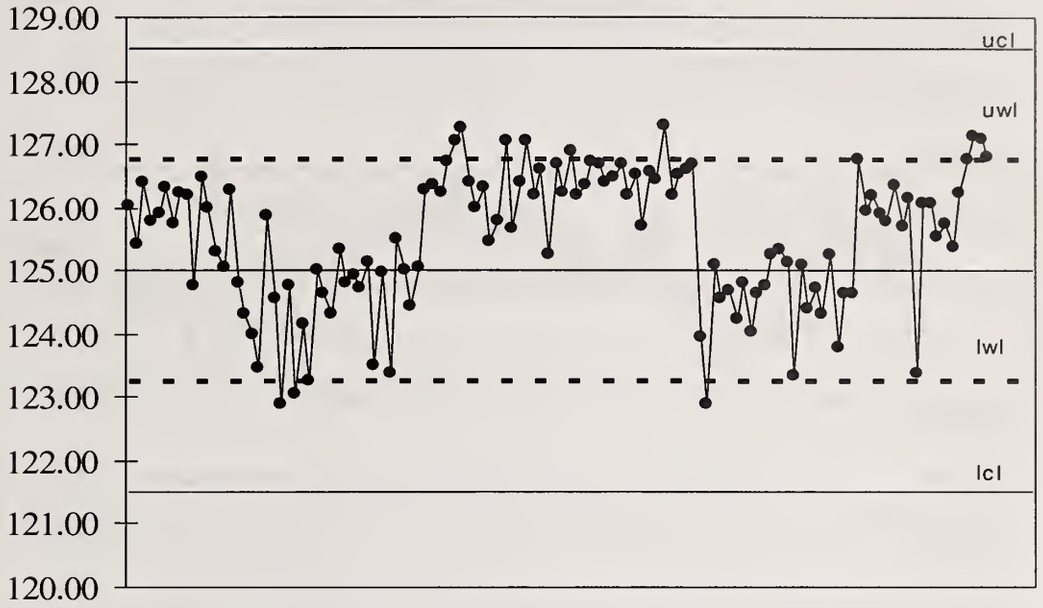


Quality Control Standard A + B

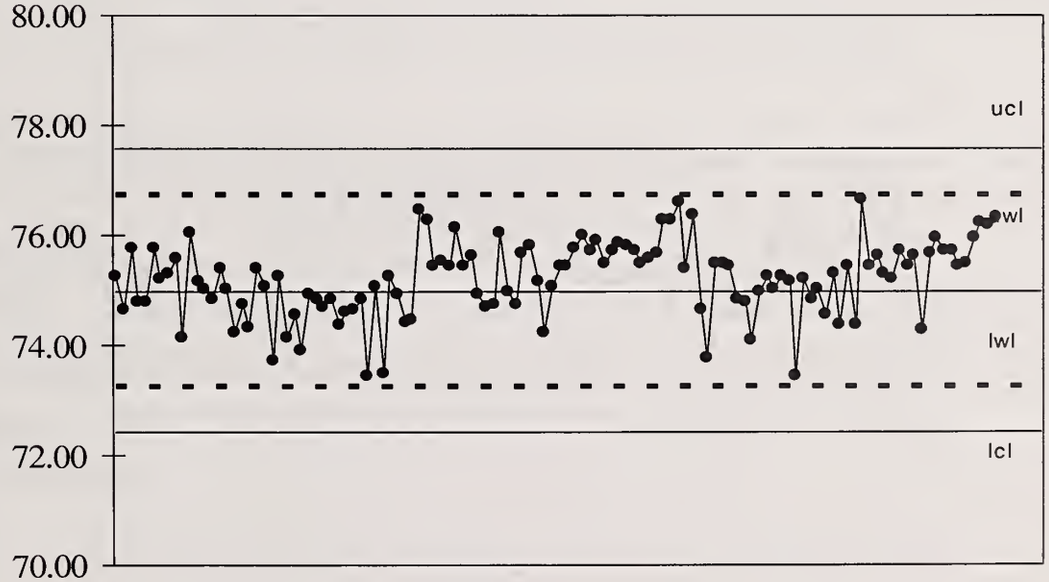


Quality Control Standard A - B

Alkalinity, Total Fixed Endpoint (E3218)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 1000.00 mg/L as $CaCO_3$

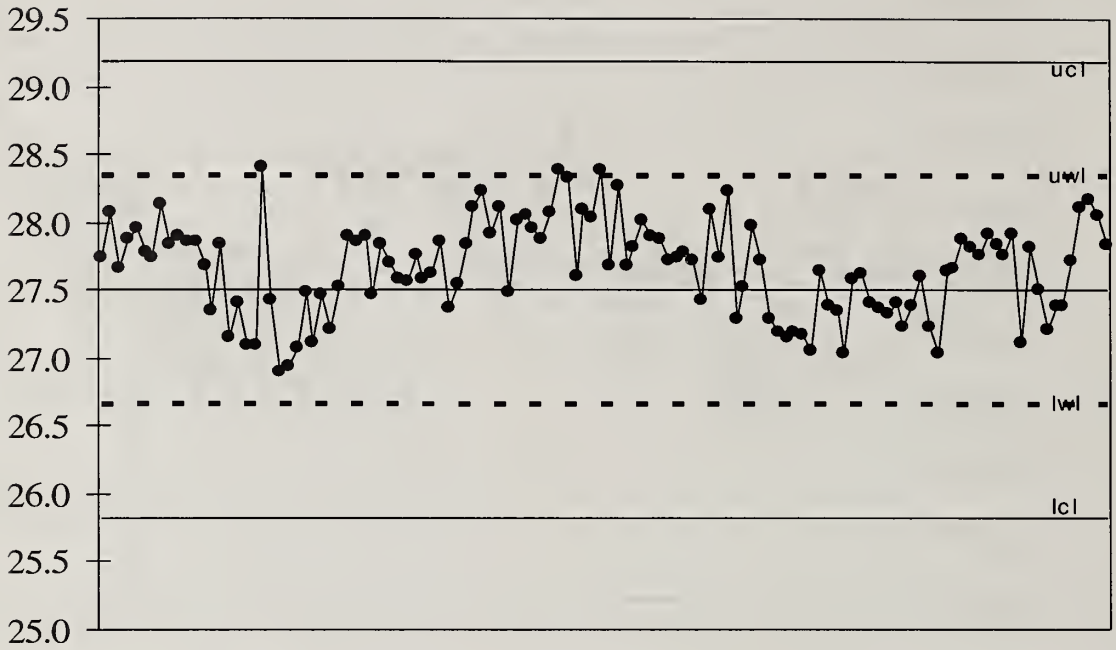


Quality Control Standard B + C

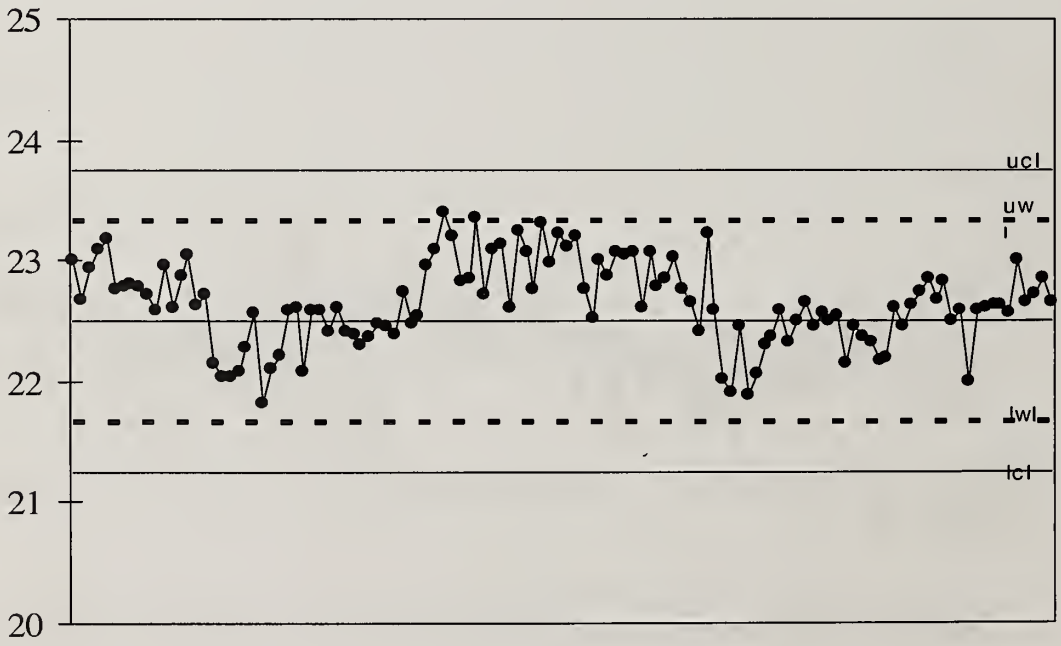


Quality Control Standard B - C

Alkalinity, Total Fixed Endpoint (E3218)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 1000.00 mg/L as $CaCO_3$



Quality Control Standard C + D



Quality Control Standard C - D

BROMATE

ACCREDITATION & DRINKING-WATER LICENSING STATUS

ACCREDITED ☑	Licensed (Drinking Water) ☑
	Drinking Water Standard (SDWA): 0.01 mg/L

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	10/09/2002
Method Reference No.	E3434	Reporting Unit	µg/L as BrO_3^-
LIMS Product Code	BROM3434	Supervisor	P.Wilson
Sample Type/Matrix	Drinking Water		

SAMPLING:

Quantity Required	50 mL
Container	PET bottle
Preservative(s)	Ethylenediamine

ANALYTICAL PROCEDURE:

Via ion chromatography (IC), Bromide and Bromate are separated from other anions using columns packed with ion exchange resin and an eluent solution of sodium carbonate. The ions of interest are detected by a conductivity detector and an Ultraviolet/visible (UV/VIS) absorbance detector. The concentration of Bromide and Bromate in µg/L as Br^- & BrO_3^- are determined by comparison of the sample scan to a series of standard scans.

INSTRUMENTATION:

Basic automated modular continuous flow ion chromatographic system with gradient flow control module, a post column delivery system (pneumatically controlled), a heated post column reaction coil, and an Ultraviolet/visible (UV/VIS) absorbance detector.

REPORTING:

Max. Significant Figures: 3	Current W value: 0.2	Current T value: 1.0	Full scale: 30.00 µg/L

CALIBRATION:

BL plus 6 standards

BROMATE cont'd

CONTROLS:

Calibration	LTBL plus 3 standards, e.g., QCA, QCB, QCC, and one certified standard
Drift	In run standards every 10 samples
Recovery	BL and samples spiked with 5 µg/L Bromate solution

NOTES:

Concentration range was extended from 15 µg/L to 30 µg/L in January 2006.

Bromate BrO_3^- (E3434)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 30.00 µg/L as BrO_3^-

Calibration Control

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	21	24.00	24.077	0.077	0.260
B	21	15.00	14.926	-0.074	0.170
C	21	6.00	5.788	-0.212	0.148
A + B		39.00	39.003	0.003	0.372
A - B		9.00	9.151	0.151	0.235
B + C		21.00	20.714	-0.286	0.277
B - C		9.00	9.138	0.138	0.158

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.220
	Within Runs	0.166
	Between/Within	1.325
s.d.(BC)	Between Runs	0.160
	Within Runs	0.112
	Between/Within	1.429

Control Limits

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	39.585	38.415	40.169	37.831
A - B	9.585	8.415	9.877	8.123
B + C	21.620	20.381	22.239	19.761
B - C	9.620	8.381	9.929	8.071

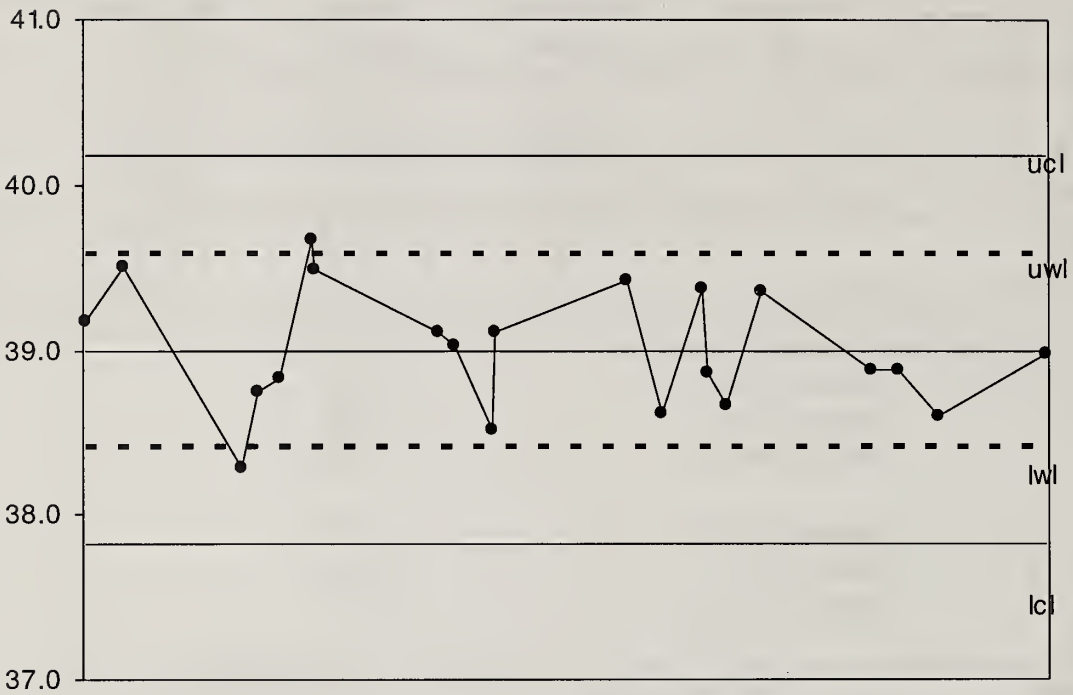
Duplicates

Number	Concentration	Std. Dev.	% Coeff of Var
8	0.00 -3.00	0.079	12.354
12	3.01 - 6.00	0.146	3.080
0	6.01 - 15.00	N/A	N/A
0	15.01 - 30.00	N/A	N/A
20	Total	0.124	3.989

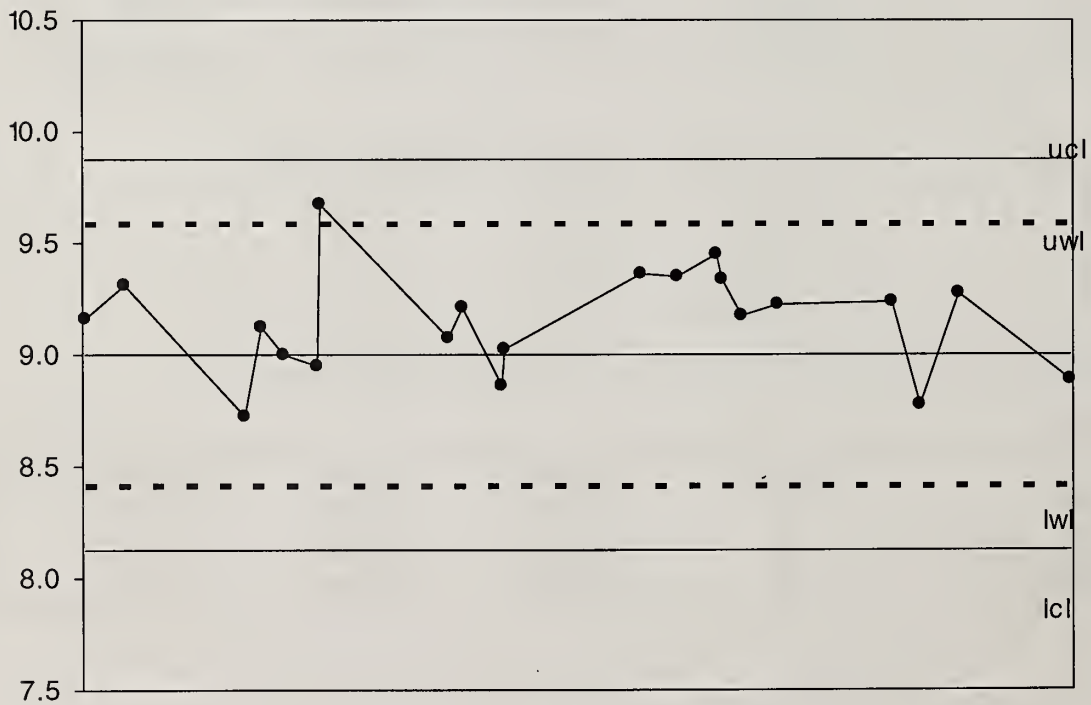
Other Checks

	Number	Expected	Mean	Mean Bias	Std. Dev.
LTB	21	0.000	0.003	0.003	0.007
Spike Recovery (5 µg/L)	48	5.000	4.580	-0.420	0.380
Cert Std	45	25.000	25.370	0.370	0.870

Bromate BrO_3^- (E3434)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 30.00 µg/L as BrO_3^-

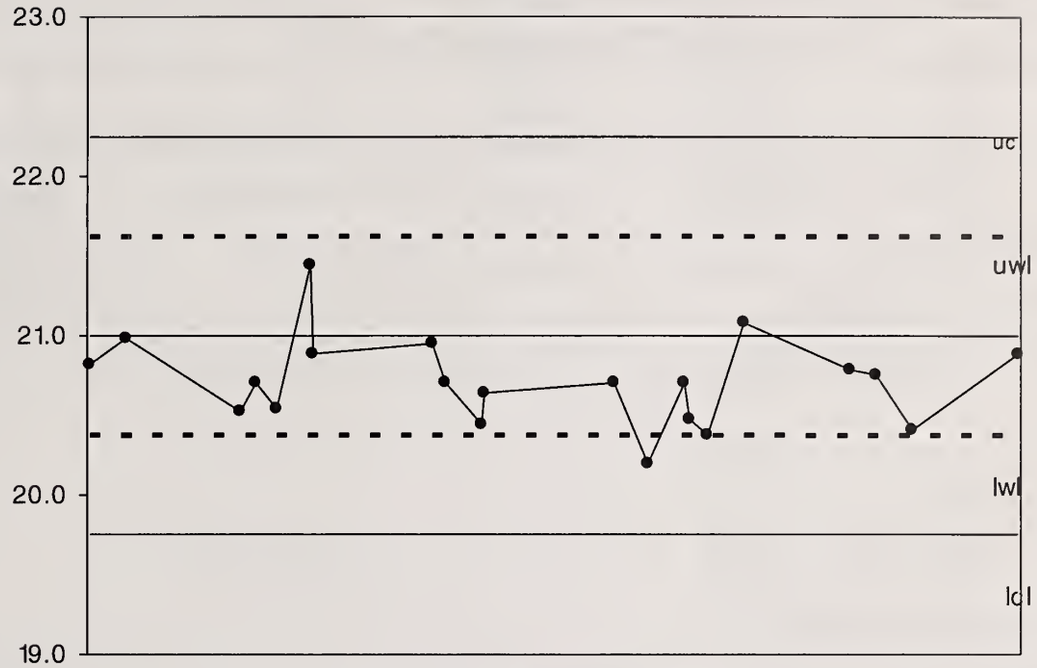


Quality Control Standard A + B

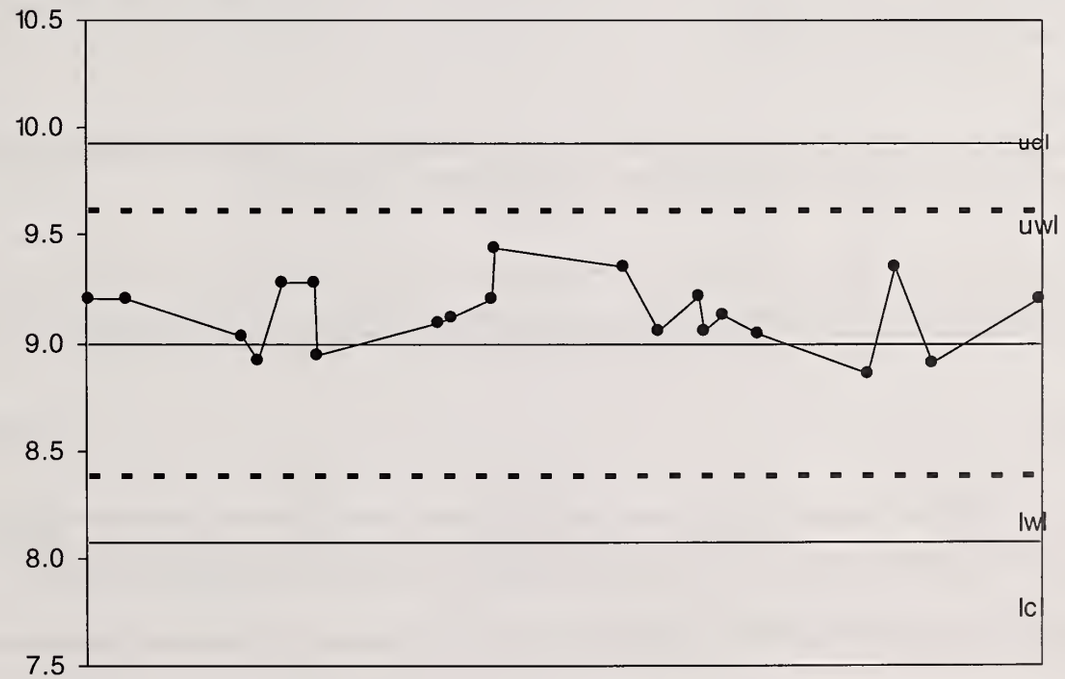


Quality Control Standard A - B

Bromate BrO_3^- (E3434)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 30.00 µg/L as BrO_3^-



Quality Control Standard B +C



Quality Control Standard B - C

BROMIDE

ACCREDITATION & DRINKING-WATER LICENSING STATUS

ACCREDITED ☑	Licensed (Drinking Water) ☑
	Drinking Water Standard (SDWA): N/A

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	10/09/2002
Method Reference No.	E3434	Reporting Unit	µg/L as Br^-
LIMS Product Code	BROM3434	Supervisor	P.Wilson
Sample Type/Matrix	Drinking Water		

SAMPLING:

Quantity Required	50 mL
Container	PET bottle
Preservative(s)	Ethylenediamine

ANALYTICAL PROCEDURE:

Via ion chromatography (IC), Bromide and Bromate are separated from other anions using columns packed with ion exchange resin and an eluent solution of sodium carbonate. The ions of interest are detected by a conductivity detector and an Ultraviolet/visible (UV/VIS) absorbance detector. The concentration of Bromide and Bromate in µg/L as Br^- & BrO_3^- is determined by comparison of the sample scan to a series of standard scans.

INSTRUMENTATION:

Basic automated modular continuous flow ion chromatographic system utilizing a gradient flow control module and a conductivity detector. The software is Chromeleon version 6.8.

REPORTING:

Max. Significant Figures: 3	Current W value: 0.2	Current T value: 1.0	Full Scale: 300.00 µg/L

CALIBRATION:

BL plus 6 standards

CONTROLS:

Calibration	LTBL plus 3 standards, e.g., QCA, QCB, QCC, and one certified standard
Drift	In run standards every 10 samples

NOTES:

The concentration range was extended from 30 µg/L to 300 µg/L in January 2006.

Bromide Br- (E3434)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 300.00 µg/L as Br^-

Calibration Control

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	34	240.00	240.406	0.406	1.214
B	34	150.00	150.081	0.081	0.964
C	34	60.00	59.723	-0.277	0.853
A + B		390.00	390.487	0.487	1.753
A - B		90.00	90.324	0.324	1.317
B + C		210.00	209.805	-0.195	1.339
B - C		90.00	90.358	0.358	1.233

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	1.392
	Within Runs	0.931
	Between/Within	1.495
s.d.(BC)	Between Runs	1.137
	Within Runs	0.872
	Between/Within	1.304

Control Limits

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	392.875	387.125	395.750	384.250
A - B	92.875	87.125	94.313	85.687
B + C	212.614	207.386	215.228	204.772
B - C	92.614	87.386	93.921	86.079

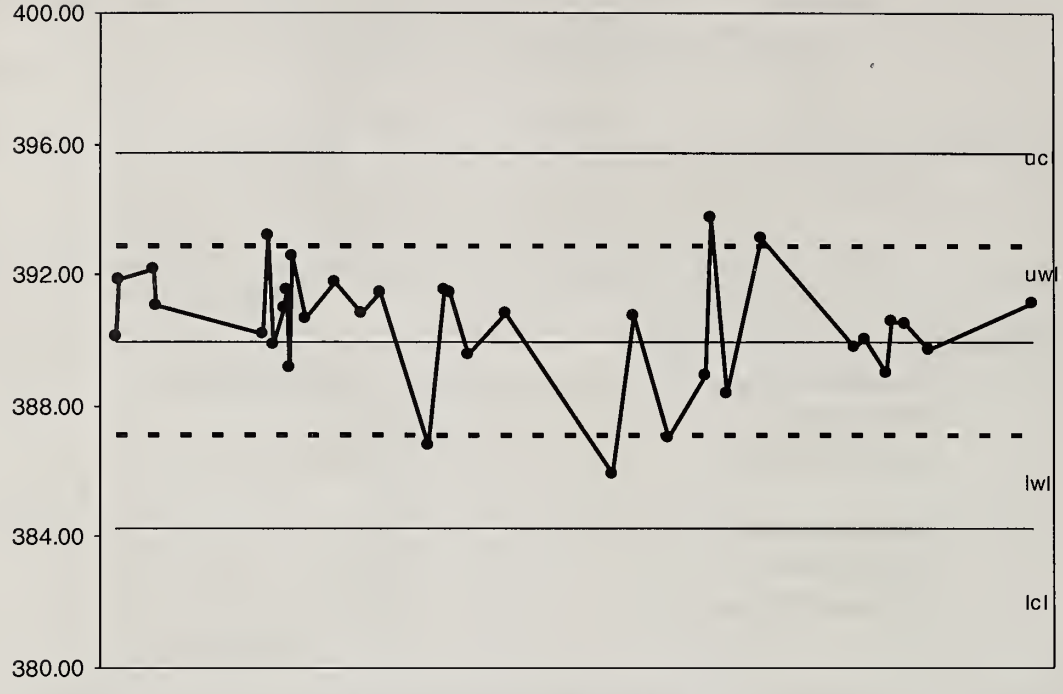
Duplicates

Number	Concentration	Std. Dev.	% Coeff of Var
51	0.00 -30.00	0.4566	4.358
10	30.01 - 60.00	0.4747	1.204
3	60.01 - 150.00	1.4506	1.631
5	150.01 - 300.00	1.3525	0.580
69	Total	0.6409	1.873

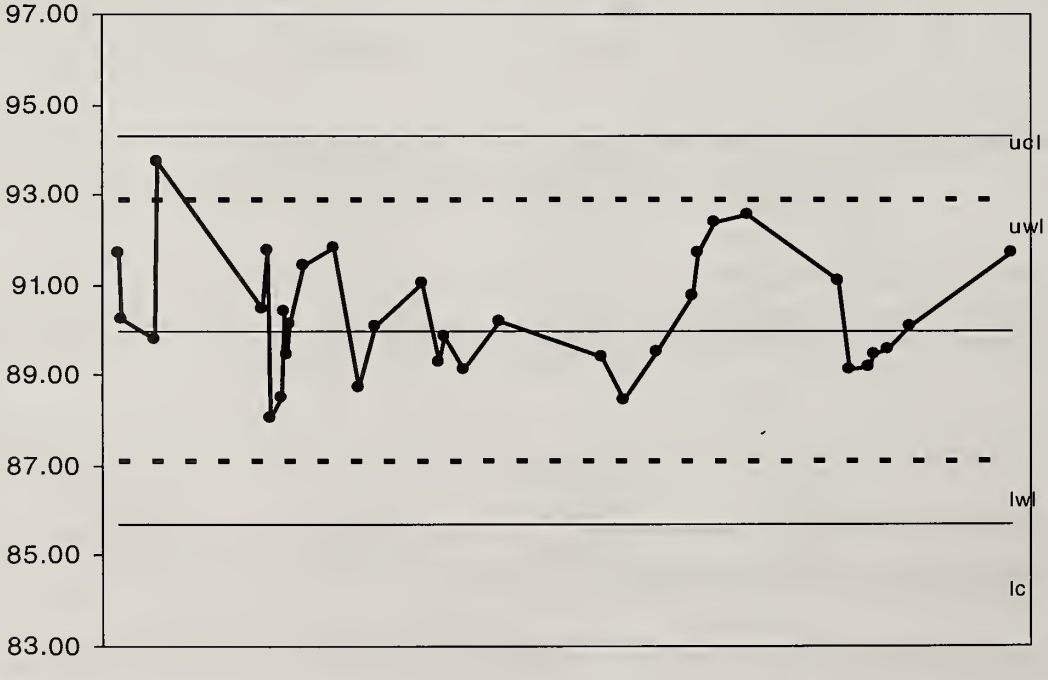
Other Checks

	Number	Expected	Mean	Mean Bias	Std. Dev.
LTB	32	0.000	0.11	0.2672	0.082
Cert Std	87	250.000	252.530	2.530	3.864

Bromide Br- (E3434)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 300.00 µg/L as Br^-

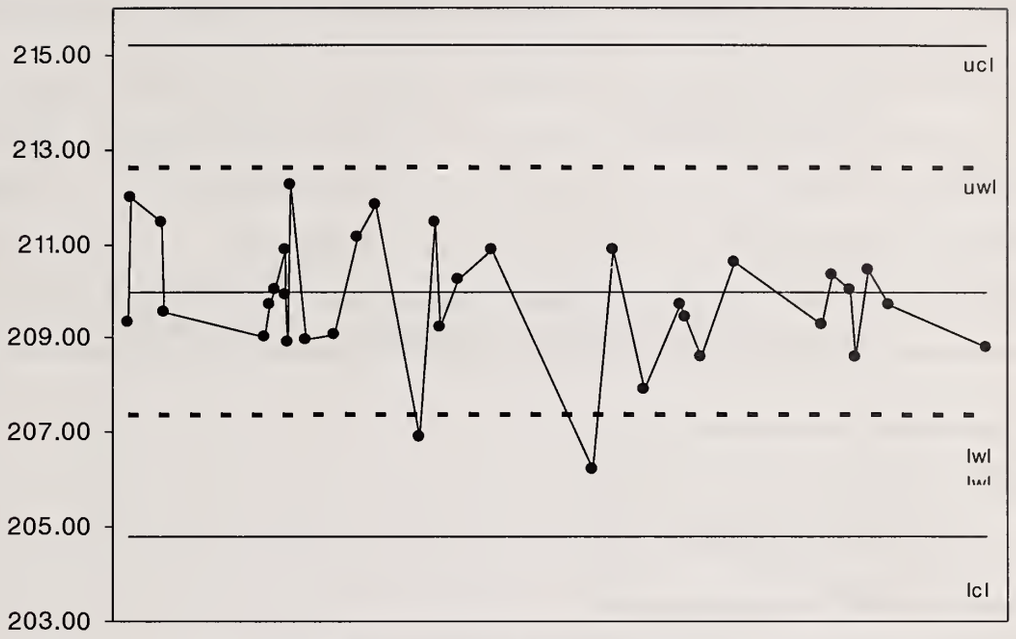


Quality Control Standard A + B

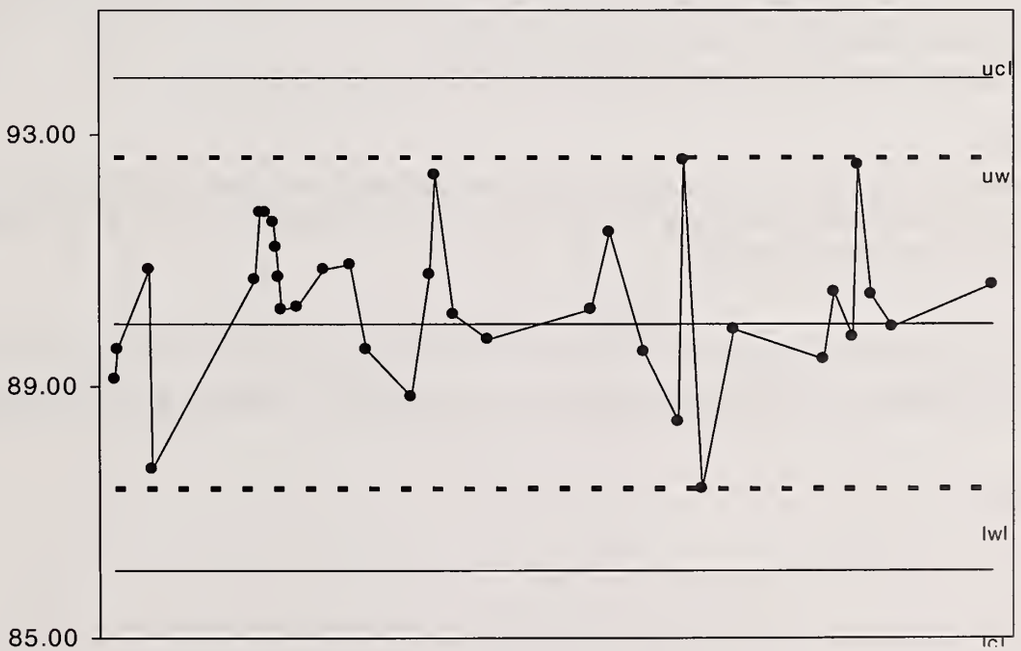


Quality Control Standard A - B

Bromide Br- (E3434)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 300.00 µg/L as Br^-



Quality Control Standard B+ C



Quality Control Standard B - C

CARBON, DISSOLVED INORGANIC

ACCREDITATION & DRINKING-WATER LICENSING STATUS

ACCREDITED ☑	Licensed (Drinking Water) ☑
	Drinking Water Standard (SDWA): N/A

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/78
Method Reference No.	E3370	Reporting Unit	mg/L as C
LIMS Product Code	DCSI3370	Supervisor	P.Wilson
Sample Type/Matrix	Effluent, Industrial Waste, Process Water, Raw Sewage, Drinking Water Ground Water, Leachates, Precipitation, Surface Water		

SAMPLING:

Quantity Required	10 mL
Container	Glass or plastic
Preservative(s)	None

ANALYTICAL PROCEDURE:

Dissolved inorganic carbon, which is determined colourimetrically on the supernatant of a settled sample, is converted to carbon dioxide gas by acidification. The gas then passes through a gas-permeable membrane into a weakly-buffered alkaline phenolphthalein solution. The decrease in absorbance of this coloured solution is a measure of the dissolved inorganic carbon content of the sample. Approximate absorbance: 0.3 at the full scale level.
Dissolved organic carbon, and reactive silicates are determined simultaneously.

INSTRUMENTATION:

Basic automated modular continuous flow system plus the following modules: air (CO_2-free) supply, dialysis unit. Colourimetric measurement is through a 5.0 cm. light path at 550 nm. Data capture and processing is via a computer system.

REPORTING:

Max. Significant Figures: 3	Current W value: 0.2	Current T value: 1.0	Full Scale: 80 mg/L

CALIBRATION:

BL plus 7 standards

CARBON, DISSOLVED INORGANIC cont'd

CONTROLS:

Calibration	LTBL plus 3 standards, e.g., QCA, QCB, QCC
Drift	BL , standard, drift control(s) and BL every 20 samples

Carbon; Dissolved Inorganic (E3370)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 80.00 mg/L as C

Calibration Control

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	77	64.000	64.014	0.014	0.453
B	77	16.000	15.950	0.050	0.239
C	77	4.000	4.080	0.080	0.127
A + B		80.000	79.964	0.036	0.575
A - B		48.000	48.064	0.064	0.441
B + C		20.000	20.030	0.030	0.312
B - C		12.000	11.869	0.131	0.222

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.362
	Within Runs	0.312
	Between/Within	1.160
s.d.(BC)	Between Runs	0.191
	Within Runs	0.157
	Between/Within	1.217

Control Limits

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	81.070	78.930	82.140	77.860
A - B	49.070	46.930	49.600	46.400
B + C	20.580	19.420	21.100	18.800
B - C	12.580	11.420	12.880	11.120

Duplicates

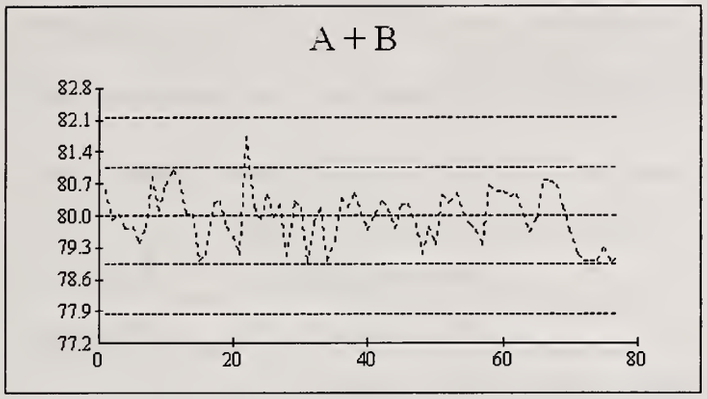
Number	Concentration	Std. Dev.	% Coeff of Var
28	0 - 10%	0.358	10.080
20	10 - 20%	0.185	1.636
127	20 - 50%	0.292	1.190
44	50 - 100%	0.403	0.751
219	Total	0.319	1.204

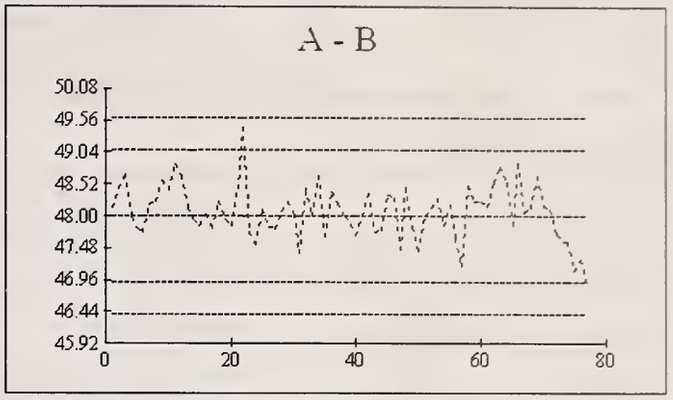
Other Checks

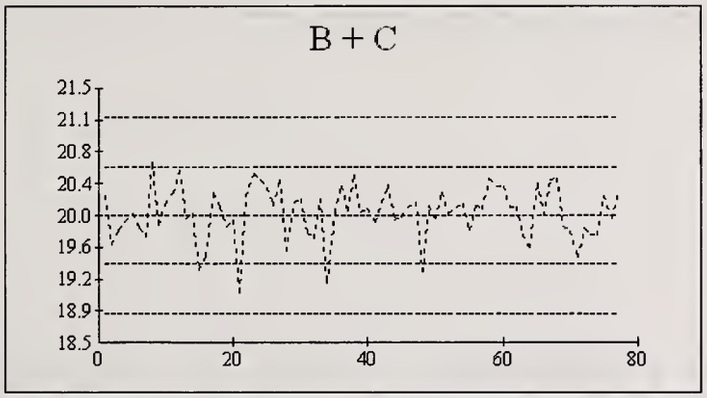
	Number	Mean	Std. Dev.
LTB	77	0.030	0.182

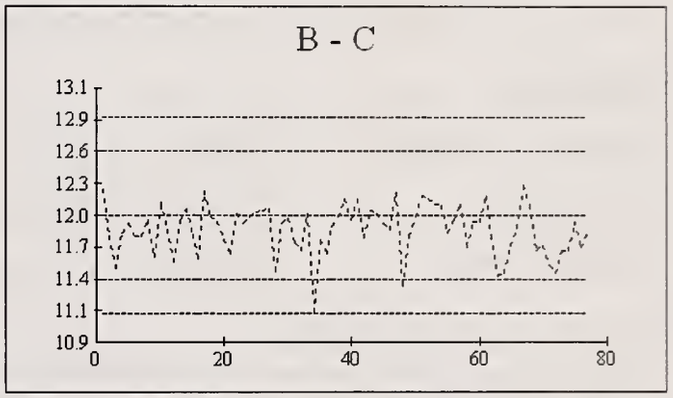
Carbon; dissolved inorganic (E3370)

QC Data: 1/1/2008 to 12/31/2008









CARBON, DISSOLVED ORGANIC

ACCREDITATION & DRINKING-WATER LICENSING STATUS

ACCREDITED ☑	Licensed (Drinking Water) ☑
	Drinking Water Standard (SDWA): N/A

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/78
Method Reference No.	E3370	Reporting Unit	mg/L as C
LIMS Product Code	DCSI3370	Supervisor	P.Wilson
Sample Type/Matrix	Effluent, Industrial Waste, Process Water, Raw Sewage, Drinking Water Ground Water, Leachates, Precipitation, Surface Water		

SAMPLING:

Quantity Required	10 mL
Container	Glass or plastic
Preservative(s)	None

ANALYTICAL PROCEDURE:

Using an automated system, the supernatant from a settled sample is acidified and flushed with nitrogen gas to remove inorganic carbon. Organic carbon is then oxidized to carbon dioxide gas by exposure to ultra-violet light (UV) in acid-persulphate media. The gas then passes through a gas-permeable membrane into a weakly-buffered alkaline phenolphthalein solution. The decrease in absorbance of this coloured solution is a measure of the dissolved organic carbon content of the sample. Approximate absorbance: 0.3 at the full scale level. Dissolved inorganic carbon, and reactive silicates are determined simultaneously.

INSTRUMENTATION:

Basic automated modular continuous flow system plus the following modules: nitrogen and air (CO_2 – free) supplies with flow controls, dialysis unit, and UV digester. Colourimetric measurement is through a 5.0 cm. light path at 550 nm. Data capture and processing is via a computer system.

REPORTING:

Max. Significant Figures: 3	Current W value: 0.1	Current T value: 0.5	Full Scale: 20mg/L

CALIBRATION:

BL plus 7 standards

CONTROLS:

Calibration	LTBL plus 3 standards, e.g., QCA, QCB, QCC
Drift	BL , standard, drift control(s) and BL every 20 samples

Carbon; Dissolved Organic (E3370)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 20.00 mg/L as C

Calibration Control

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	77	16.000	16.052	0.052	0.098
B	77	4.000	4.009	0.009	0.095
C	77	1.000	1.006	0.006	0.066
A + B		20.000	20.061	0.061	0.158
A - B		12.000	12.042	0.042	0.111
B + C		5.000	5.015	0.015	0.136
B - C		3.000	3.003	0.003	0.091

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.097
	Within Runs	0.078
	Between/Within	1.244
s.d.(BC)	Between Runs	0.082
	Within Runs	0.064
	Between/Within	1.281

Control Limits

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	20.280	19.720	20.560	19.440
A - B	12.280	11.720	12.420	11.580
B + C	5.220	4.780	5.440	4.560
B - C	3.220	2.780	3.330	2.670

Duplicates

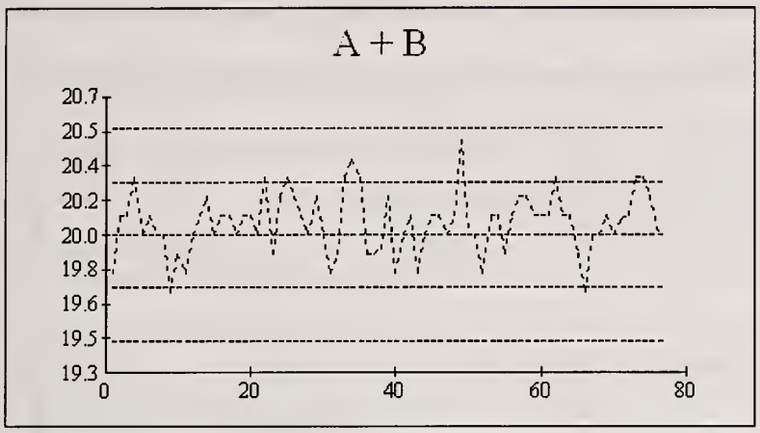
Number	Concentration	Std. Dev.	% Coeff of Var
74	0 - 10%	0.118	8.802
71	10 - 20%	0.181	6.261
69	20 - 50%	0.161	2.709
6	50 - 100%	0.138	1.093
220	Total	0.155	4.315

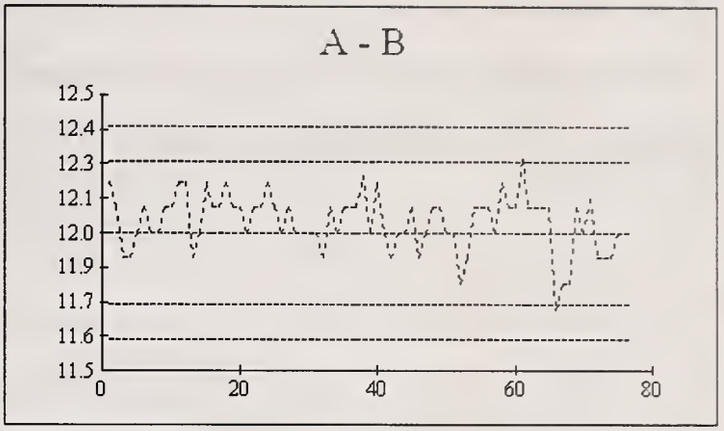
Other Checks

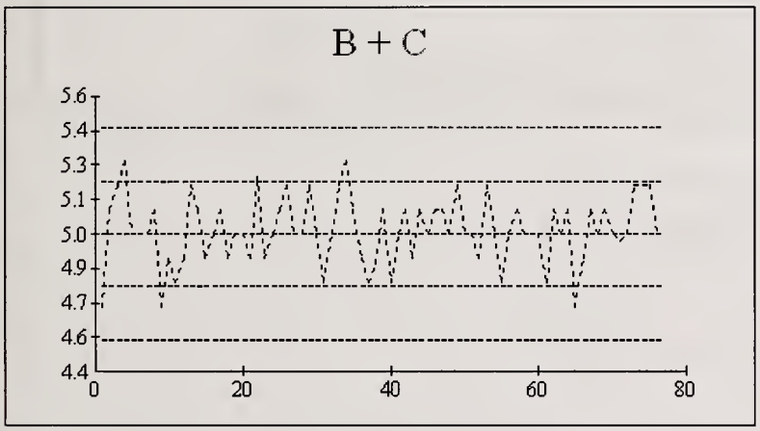
	Number	Mean	Std. Dev.
LTB	77	0.009	0.141

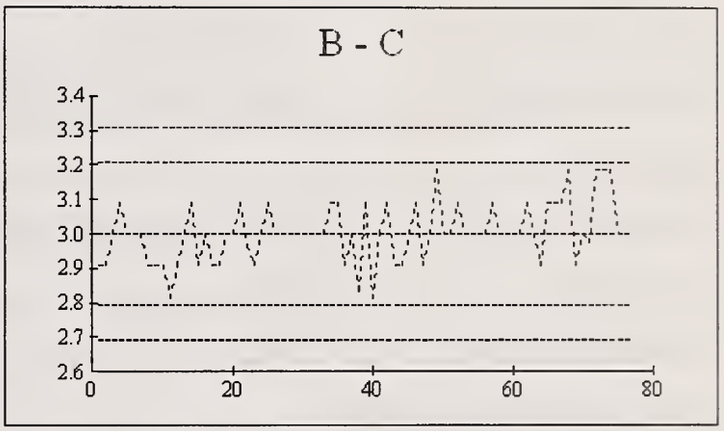
Carbon; dissolved organic (E3370)

QC Data: 1/1/2008 to 12/31/2008









CHLORIDE

ACCREDITATION & DRINKING-WATER LICENSING STATUS

ACCREDITED ☑	Licensed (Drinking Water) N/A
	Drinking Water Standard (SDWA): N/A

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/78
Method Reference No.	E3004	Reporting Unit	$\mu g/m^3$ as Cl
LIMS Product Code	ANION3004	Supervisor	P. Wilson
Sample Type/Matrix	Air; HiVol Glass Fibre, Quartz and Polyflon, Other Filters and Puff		

SAMPLING:

Quantity Required	¾" or 1.9cm strip from 8"x10" filter
Container	N/A
Preservative(s)	N/A

SAMPLING PREPARATION:

A ¾" filter strip is cut in pieces and deposited into a 50 mL polypropylene tube. 50 mL of Pure-Water is added to the tube. The tube is placed on a horizontal shaker for approximately 1 hour. The supernatant is then filtered into a 15 mL plastic tube and analysed.

ANALYTICAL PROCEDURE:

Chloride is separated from other anions in the sample by automated suppressed ion chromatography using an eluent mixture of sodium bicarbonate and sodium carbonate and a conductivity detector. The concentration of chloride (mg/L) is determined by the comparison of the analyte peak area count to that of a series of standards. The analyte result is corrected for the filter blank before the final calculation. The result is reported as $\mu g/m^3$ as Cl.

Nitrate and sulphate are determined simultaneously.

INSTRUMENTATION:

Horizontal Shaker, ion chromatographic system plus a PC with ChromPerfect software and DT2804 card for automated sample injection, timing, and data processing.

REPORTING:

Max. Significant Figures:	Current W value:	Current T value:	Full Scale:
3	0.1 $\mu g/m^3$	0.5 $\mu g/m^3$	100mg/L

CALIBRATION:

9 standards

CHLORIDE cont'd

CONTROLS:

Calibration	MB, CS1, CS2, QCA and QCB
Drift	2 standards every 20 samples
Recovery	CS4 & CS5

NOTES:

To convert unit from mg/L to $\mu g/m^3$, the final concentration of Cl in $\mu g/m^3$ is calculated by the following formula:

$$\text{Result (mg/L)} \times 50\text{mL} \times (63/6.75) / \text{air volume} = \mu g/m^3$$

Where: 63 is the area of the filter exposed and 6.75 is the sample aliquot area in square inch.

Chloride Cl^- (E3004)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 28.6 µg/m^3 (100.00 mg/L) as Cl^-

Calibration Control

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	6	80.00	79.797	-0.203	0.652
B	6	20.00	19.938	-0.062	0.186
A + B		100.00	99.735	-0.265	0.693
A - B		60.00	59.859	-0.141	0.663

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.480
	Within Runs	0.469
	Between/Within	1.023

Control Limits

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	101.190	98.810	102.370	97.630
A - B	61.190	58.810	61.780	58.220

Duplicates: (µg/m^3)

Number	Concentration	Std. Dev.	% Coeff of Var
17	0.0-2.86	0.014	8.148
1	2.89-7.15	N/A	N/A

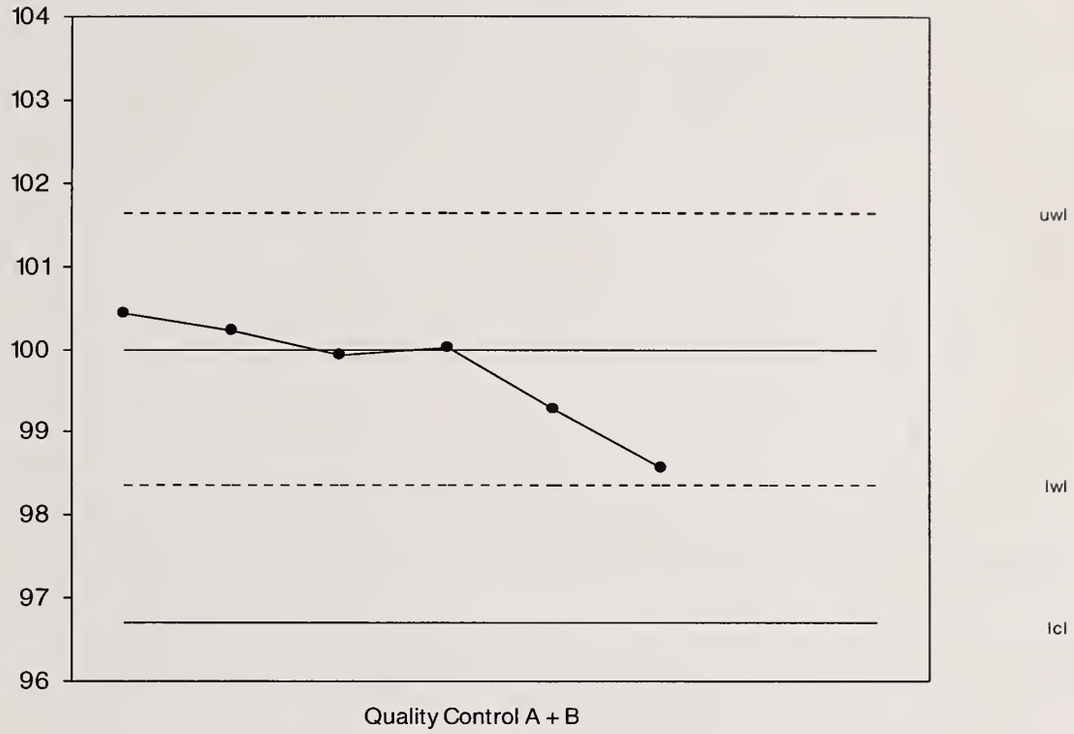
Check & Recovery Standards: (µg/m^3)

	Number	Expected	Mean	Mean Bias	Std. Dev.
CS1	6	8.620	8.660	0.040	0.107
CS2	6	90.004	89.365	-0.639	0.447
CS4	6	3.090	2.970	-0.120	0.129
CS5	6	19.140	19.065	-0.125	0.686

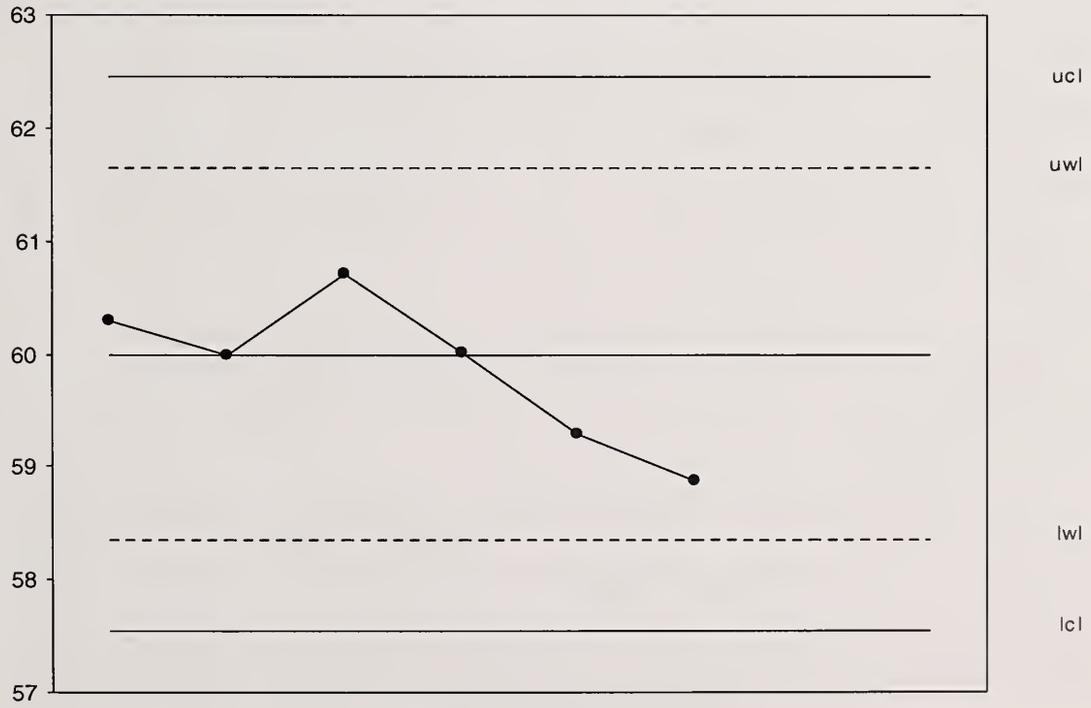
Control Limits: (µg/m^3)

Check & Recovery Standards	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
CS1	9.290	8.710	9.440	8.560
CS2	91.280	88.720	91.910	88.090
CS4	3.420	2.760	3.590	2.590
CS5	20.210	18.070	20.750	17.530

Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 28.6 µg/m^3 (100.00 mg/L) as Cl^-

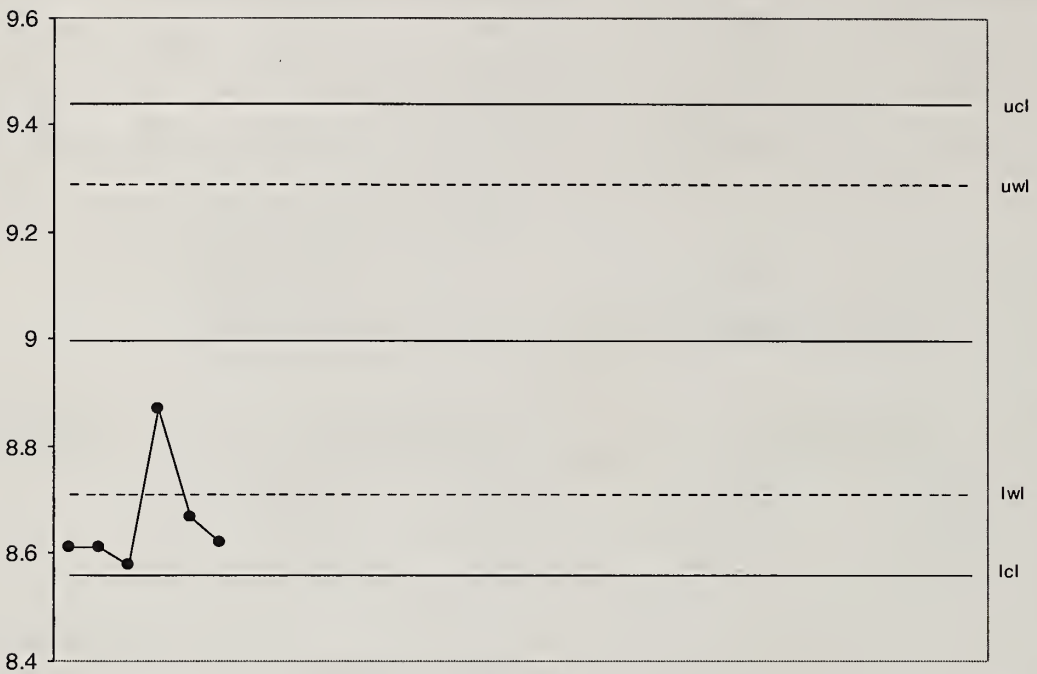


Quality Control A + B

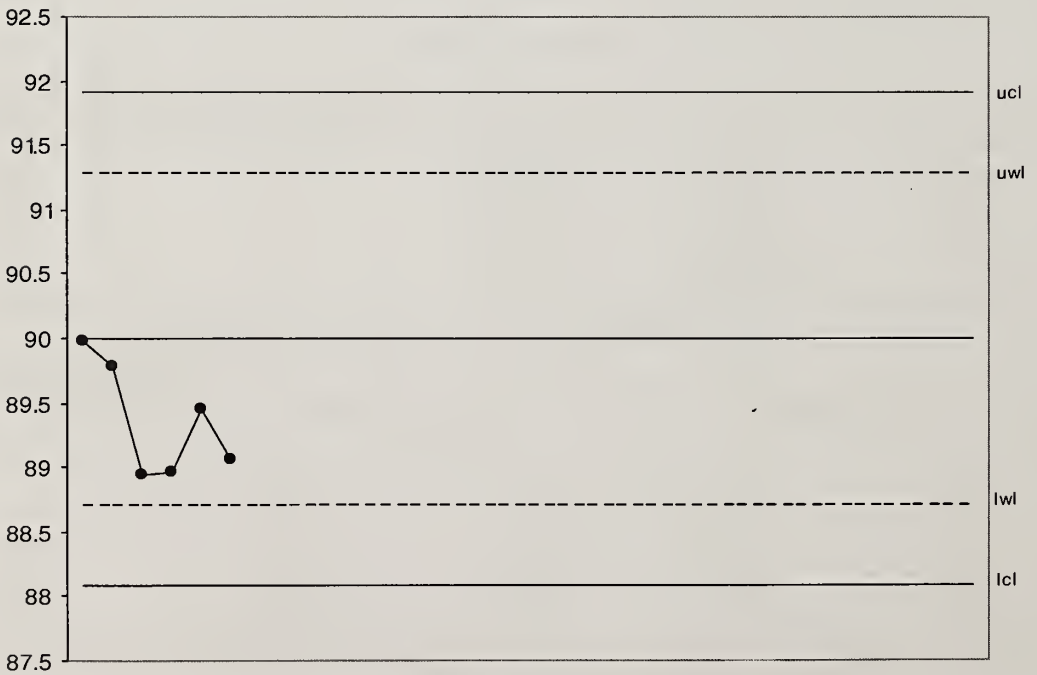


Quality Control A - B

Chloride Cl^- (E3004)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 28.6 µg/m^3 (100.00 mg/L) as Cl^-

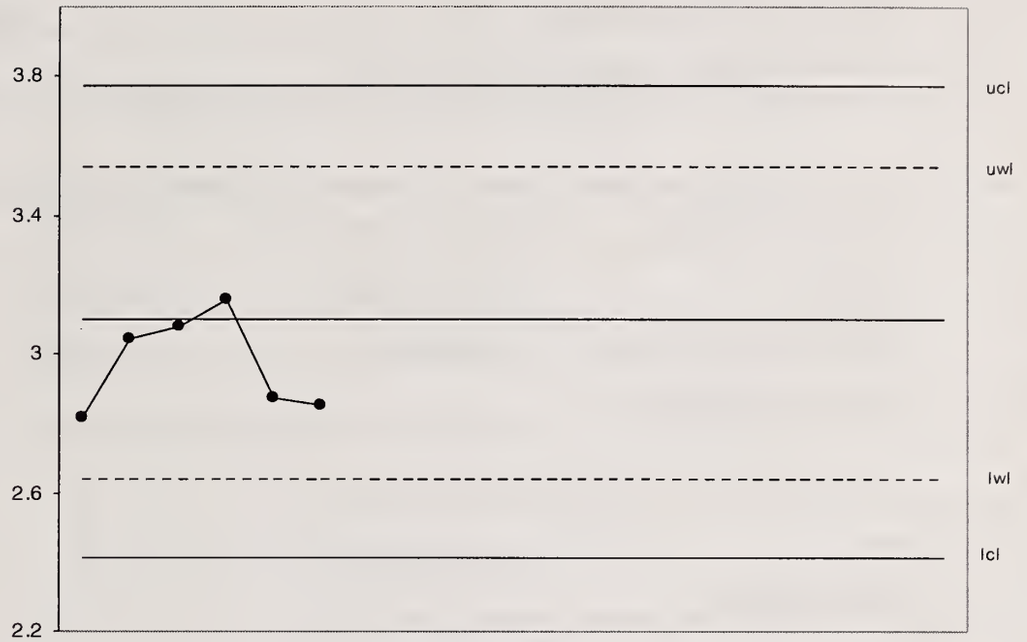


Quality Control CS1

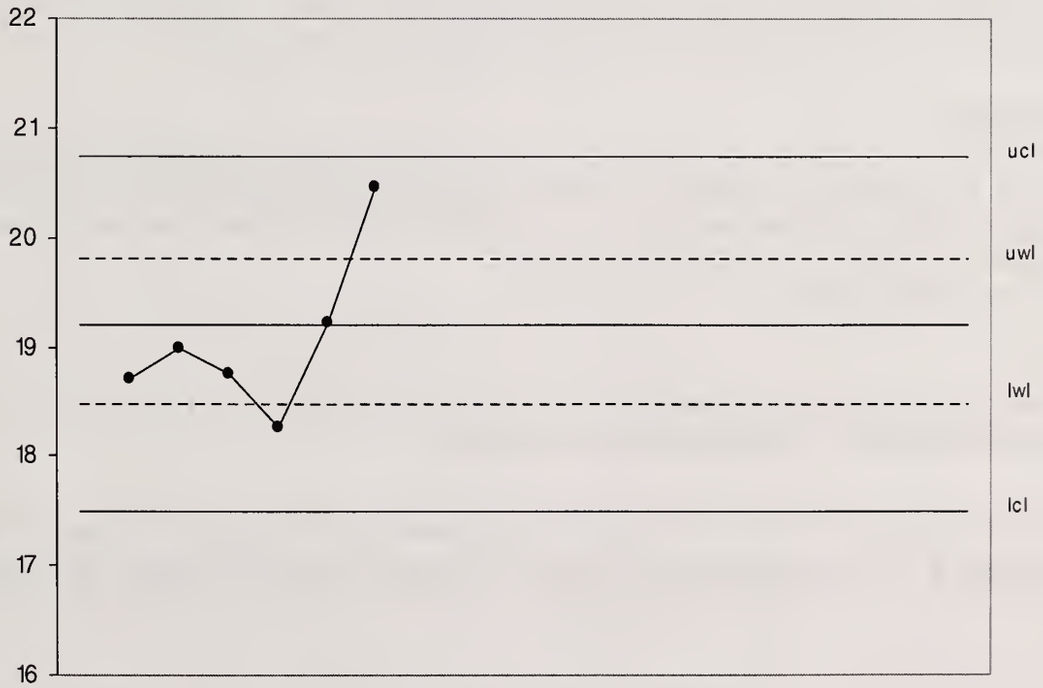


Quality Control CS2

Chloride Cl^- (E3004)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 28.6 µg/m^3 (100.00 mg/L) as Cl^-



Quality Control CS4



Quality Control CS5

CHLORIDE

ACCREDITATION & DRINKING-WATER LICENSING STATUS

ACCREDITED ☑	Licensed (Drinking Water) N/A
	Drinking Water Standard (SDWA): N/A

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/01/86
Method Reference No.	E3013	Reporting Unit	µg/g as Cl
LIMS Product Code	ANION3013, CL3013	Supervisor	P. Wilson
Sample Type/Matrix	Soil and Sediment		

SAMPLING:

Quantity Required	20 g
Container	glass or plastic
Preservative(s)	N/A

SAMPLING PREPARATION:

A 3.0g sample of air dried, sieved soil or air dried sieved and ground sediment is placed in a 50 mL centrifuge tube and shaken with 30 mL Pure-DW for 1 hour on a shaker. Samples are centrifuged, membrane filtered and analyzed for chloride and sulphate by ion chromatography.

ANALYTICAL PROCEDURE:

Chloride is separated from other anions in the sample by automated suppressed ion chromatography using an eluent mixture of sodium bicarbonate and sodium carbonate and a conductivity detector. The concentration of chloride (mg/L) is determined by the comparison of the analyte peak area count to that of a series of standards. The result is reported as µg/g as Cl.
Sulphate is determined simultaneously.

INSTRUMENTATION:

Horizontal Shaker, ion chromatographic system plus a PC with ChromPerfect software and DT2804 card for automated sample injection, timing, and data processing.

REPORTING:

Max. Significant Figures: 3	Current W value: 0.5 µg/g	Current T value: 2.5 µg/g	Full Scale: 100 mg/L

CALIBRATION:

9 standards

CHLORIDE cont'd

CONTROLS:

Calibration	MB, CS1, CS2, QCA and QCB
Recovery	R21, SO201, SO202, R23, R16
Drift	2 standards every 20 samples

NOTES:

New limits were established in April 2006 for R16, R21, R23, SO201 and SO202.

Chloride Cl^- (E3013)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 100.00 mg/L as Cl^-

Calibration Control

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	4	80.00	79.888	-0.112	0.841
B	4	20.00	19.893	0.053	0.250
A + B		100.00	99.781	-0.519	1.052
A - B		60.00	59.995	-0.625	0.658

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.620
	Within Runs	0.465
	Between/Within	1.333

Control Limits

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	101.790	98.210	103.580	96.420
A - B	61.790	58.210	62.680	57.320

Duplicates: (µg/L)

Number	Concentration	Std. Dev.	% Coeff of Var
7	0 - 200	0.361	1.382
3	201 - 500	11.930	3.644
2	501 - 1000	N/A	N/A

Recoveries: (µg/L)

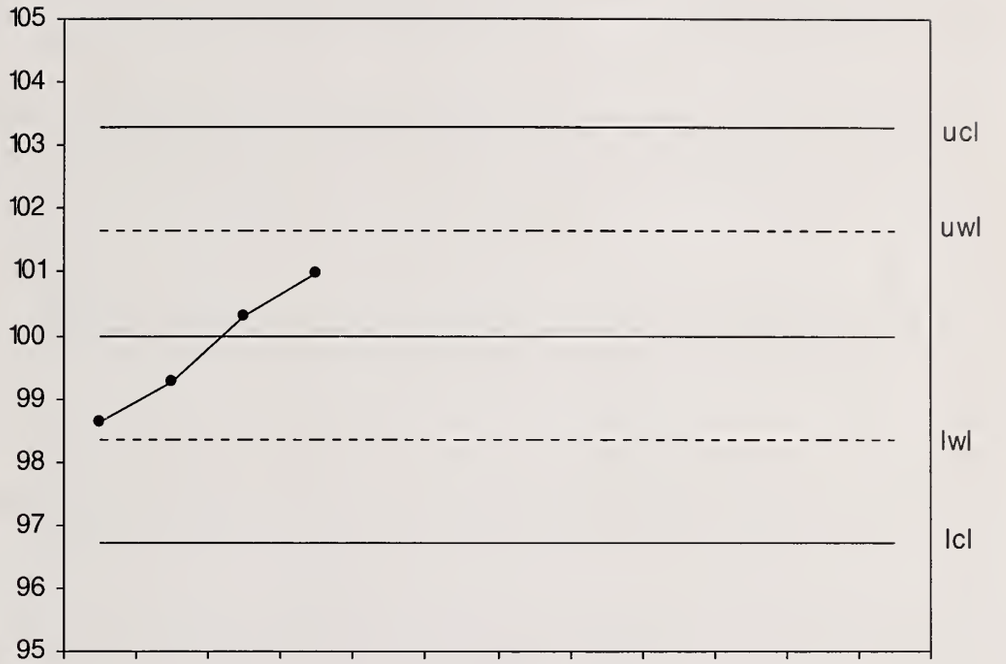
	Number	Expected	Mean	Mean Bias	Std. Dev.
SO201	9	33.000	31.175	-1.825	6.219
SO202	9	3.300	4.008	0.708	0.435
R16	9	34.300	40.185	5.885	4.077
R21	9	16.900	16.965	0.065	0.800
R23	8	7250.000	7194.533	-55.467	79.945

Control Limits: (µg/L)

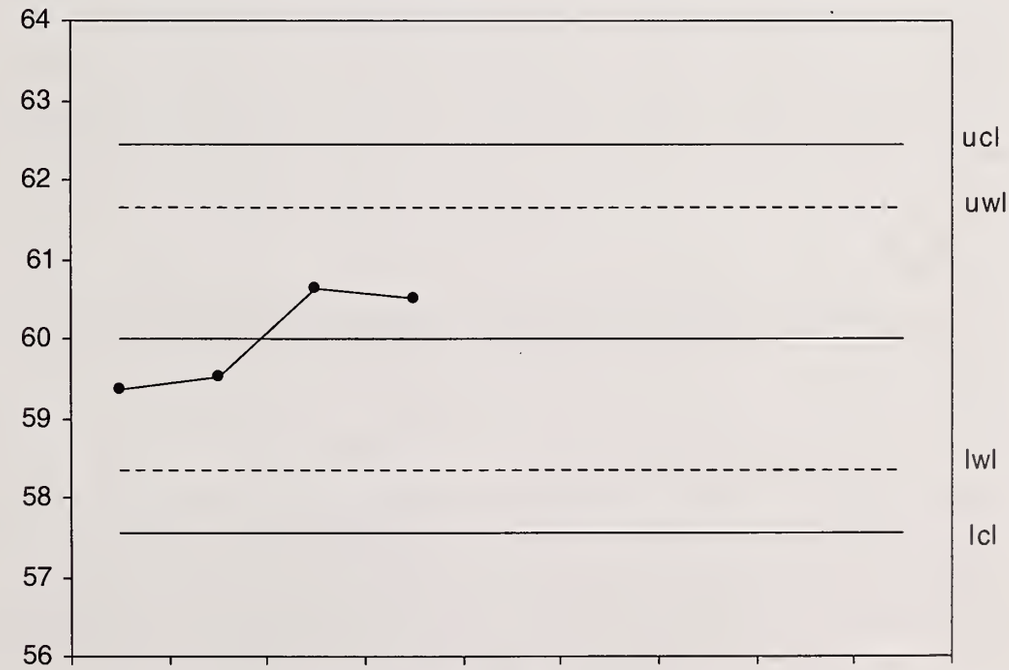
Check Standard	Control Limits	
	Upper	Lower
SO201	47.900	18.200
SO202	4.800	1.800
R16	24.500	9.300
R21	56.300	12.300
R23*	7922.000	6577.000

* Tentative

Chloride Cl^- (E3013)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 100.00 mg/L as Cl^-

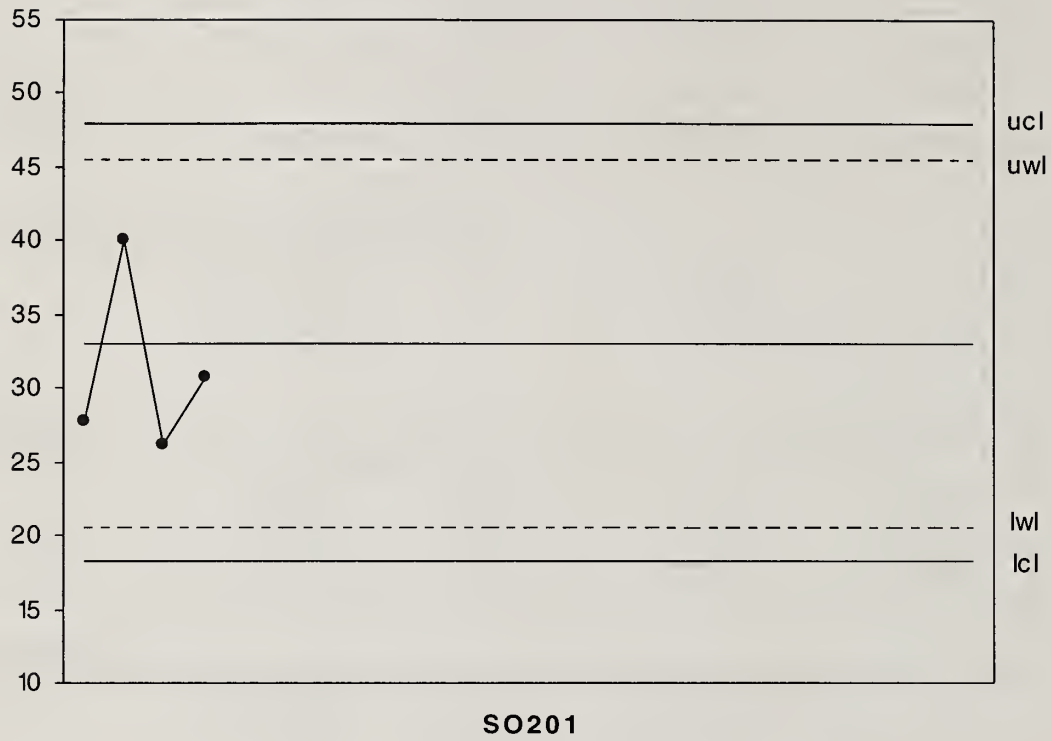


Quality Control A + B

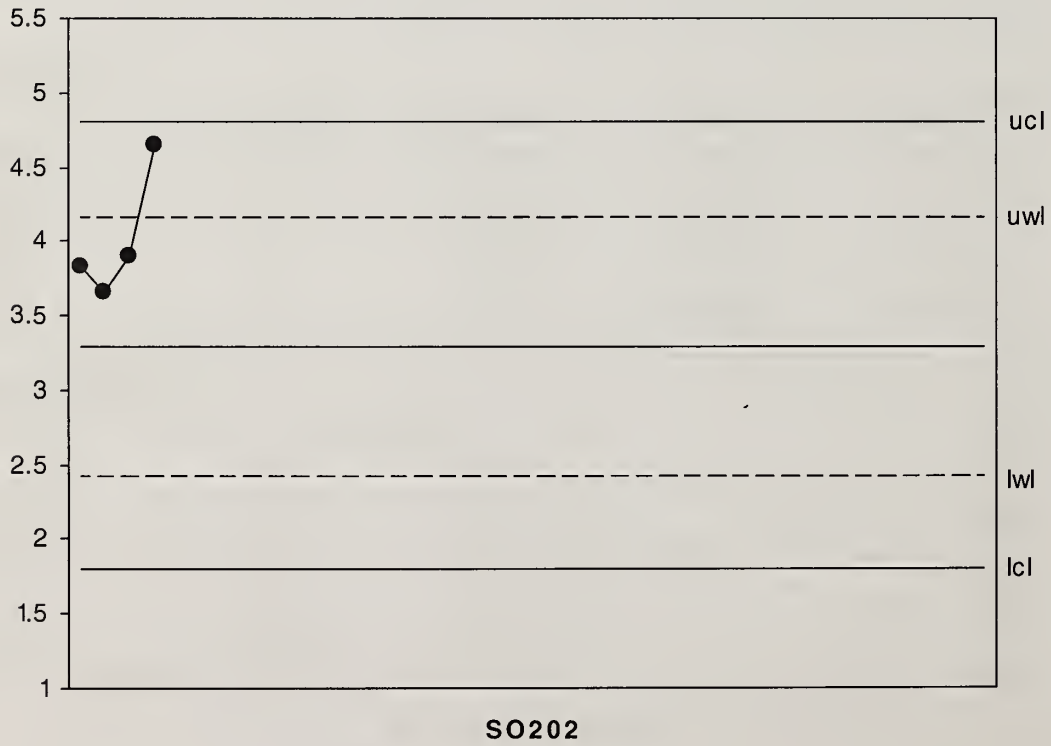


Quality Control A - B

Chloride Cl^- (E3013)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 100.00 mg/L as Cl^-

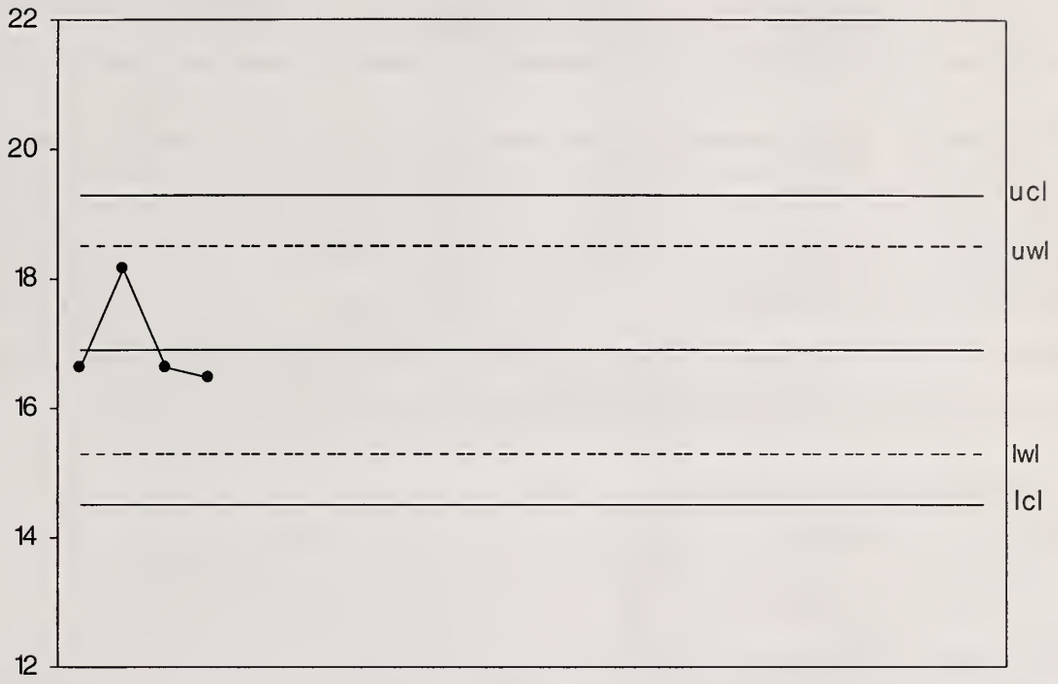


SO201

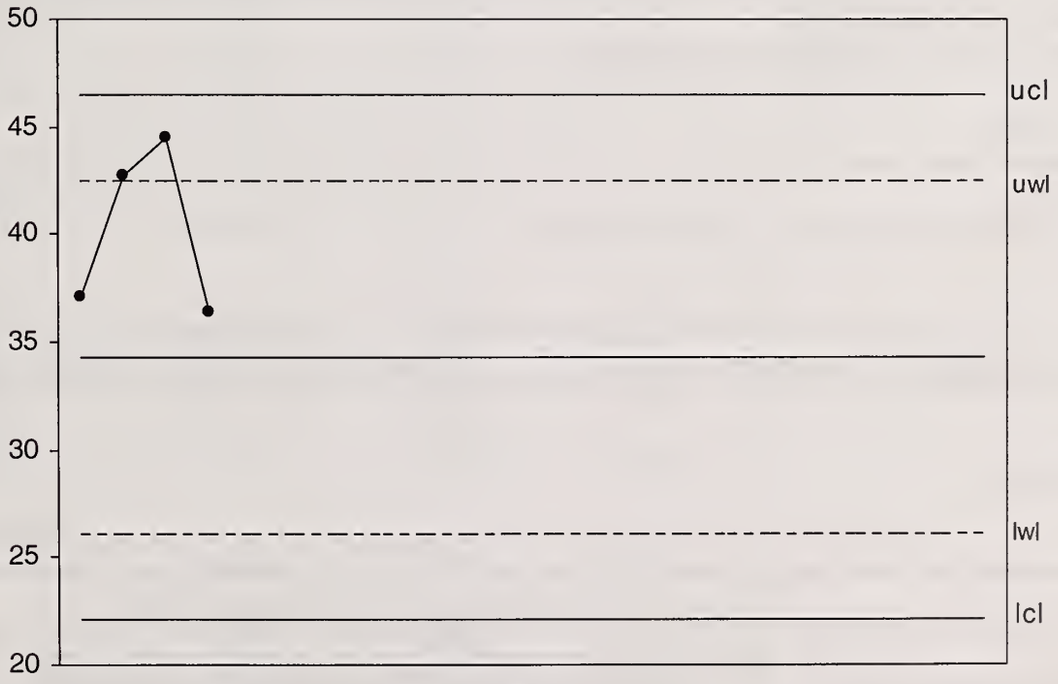


SO202

Chloride Cl^- (E3013)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 100.00 mg/L as Cl^-



R21



R16

CHLORIDE

ACCREDITATION & DRINKING-WATER LICENSING STATUS

ACCREDITED ☑	Licensed (Drinking Water) ☑
	Drinking Water Standard (SDWA): N/A

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/05/75
Method Reference No.	E3016	Reporting Unit	mg/L as Cl
LIMS Product Code	CL3016	Supervisor	P. Wilson
Sample Type/Matrix	Effluent, Industrial Waste, Process Water, Raw Sewage, Drinking Water, Ground Water, Leachate, Surface Water		

SAMPLING:

Quantity Required:	10 mL
Container:	Plastic
Preservative(s)	None

ANALYTICAL PROCEDURE:

Chloride ions are combined with mercuric thiocyanate releasing thiocyanate quantitatively. Thiocyanate then reacts with ferric ions to produce ferric thiocyanate (red), and the absorbance of the latter is measured colourimetrically.
Approximate absorbance: 0.5 at the full scale level.

INSTRUMENTATION:

Basic automated modular continuous flow system with colourimetric measurement through a 1.5 cm light path at 480 nm.
Data capture and processing is via a computer system.

REPORTING:

Max. Significant Figures: 3	Current W value: 0.2	Current T value: 1.0	Full Scale: 100 mg/L

CALIBRATION:

BL plus 12 standards

CONTROLS:

Calibration:	LTBL plus 3 standards, e.g. QCA, QCB, QCC
Drift:	BL , standard, drift control(s) after every 25 samples

Chloride (E3016)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 100.00 mg/L as Cl

Calibration Control

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	78	75	74.903	0.097	0.283
B	78	25	25.034	0.034	0.133
C	78	5	4.863	0.137	0.088
A + B		100	99.937	0.063	0.347
A - B		50	49.869	0.131	0.274
B + C		30	29.897	0.103	0.19
B - C		20	20.171	0.171	0.122

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.221
	Within Runs	0.194
	Between/Within	1.139
s.d.(BC)	Between Runs	0.113
	Within Runs	0.086
	Between/Within	1.314

Control Limits

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	100.700	99.300	101.300	98.700
A - B	50.700	49.300	51.000	49.000
B + C	30.340	29.660	30.700	29.300
B - C	20.340	19.660	20.500	19.500

Duplicates

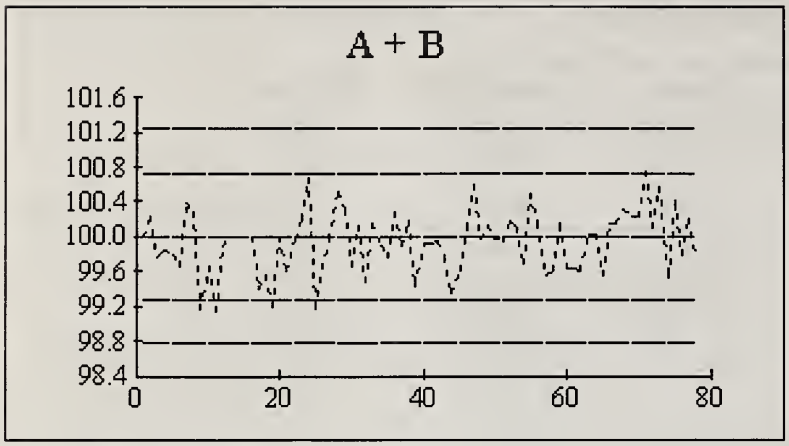
Number	Concentration	Std. Dev.	% Coeff of Var
50	0 - 10%	0.111	2.806
42	10 - 20%	0.138	0.897
85	20 - 50%	0.249	0.877
33	50 - 100%	0.924	1.295
210	Total	0.408	1.526

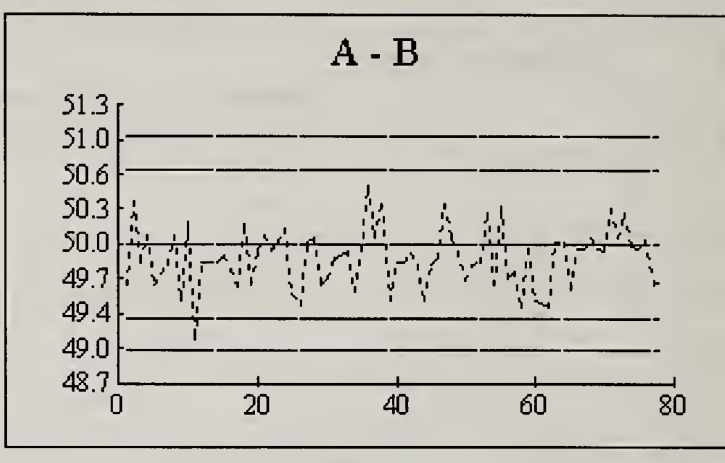
Other Checks

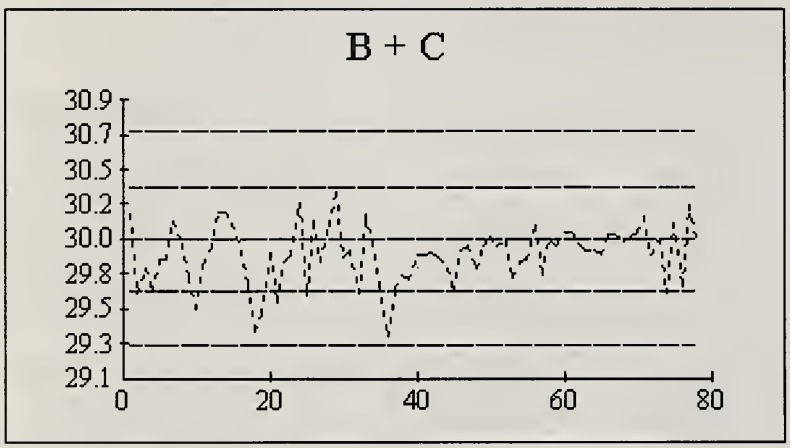
	Number	Mean	Std. Dev.
LTB	78	-0.052	0.053

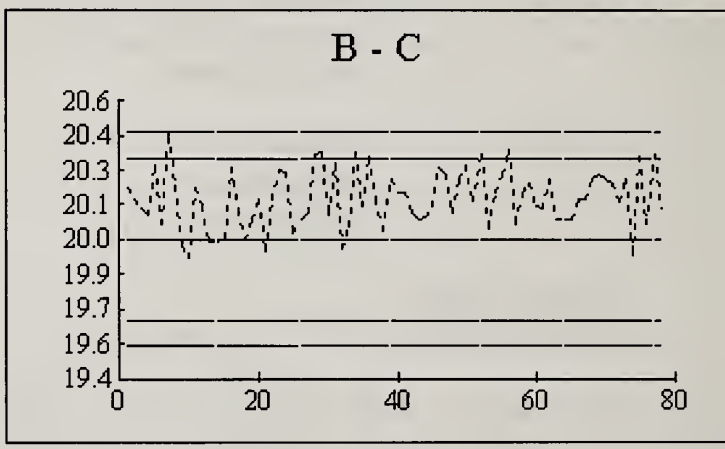
Chloride (E3016)

QC Data; 1/1/2008 to 12/31/2008









CHLOROPHYLL

ACCREDITATION & DRINKING-WATER LICENSING STATUS

ACCREDITED ☑	Licensed (Drinking Water) No
	Drinking Water Standard (SDWA): N/A

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/75
Method Reference No	E3169	Reporting Unit	µg/L
LIMS Product Code	CHL3169	Supervisor	P. Wilson
Sample Type/Matrix	Effluent, Drinking Water, Surface Water		

SAMPLING:

Quantity Required	500 mL for clear samples; 250 mL if visibly green
Container	Glass or plastic
Other	In the field a sample is filtered through a nylon filter. The filter is then placed between two membrane filter-support pads, and the package is enclosed in a plastic dish labelled with the sample number and sample volume filtered, the dish is kept in the dark or wrapped in aluminium foil, and shipped immediately, or kept frozen.

ANALYTICAL PROCEDURE:

Chlorophyll 'a', chlorophyll 'b', and corrected chlorophyll 'a' (for pheophytin 'a') are determined by the extraction of the pheopigments into an acetone-water solvent followed by two computer controlled spectrophotometric scans with measurements at 630, 645 and 663 (665 for acidified) nm absorbance measurements. Also, the minimum absorbance between 710 and 750 is measured to allow for a correction due to turbidity. SCOR-UNESCO equations are used for all chlorophyll calculations.

INSTRUMENTATION:

Automated modular continuous flow scanning spectrophotometer system
Computer system for control of sampling, timing and data processing (i.e. data capture, calculations and transfer of results to eLAB and LIMS)

CHLOROPHYLL cont'd

REPORTING:

Chlorophyll a; corrected Chlorophyll a; total Chlorophyll b; total	Max. Significant Figures: 3	Current W value: 1.0 Current W value: 0.2 Current W value: 0.1	Current T value: 5.0 Current T value: 1.0 Current T value: 0.5

CONTROLS:

Calibration	LTBL plus 2 "standards", e.g. QCA, QCB
Drift	"standard", BL every 20 samples

NOTES:

"Standards" are prepared from chlorophyll "a" and "b", but the materials are neither analytical grade nor are their solutions stable. Thus calibration controls are based on measured averages.

Chlorophyll "A" (E3169)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 4.00 µg/L

Calibration Control

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	47	3.00	3.030	0.030	0.097
B	47	1.00	1.071	0.071	0.050
A + B		4.00	4.100	0.100	0.115
A - B		2.00	1.959	-0.041	0.101

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.077
	Within Runs	0.072
	Between/Within	1.069

Control Limits

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	4.200	3.800	4.400	3.600
A - B	2.200	1.800	2.300	1.700

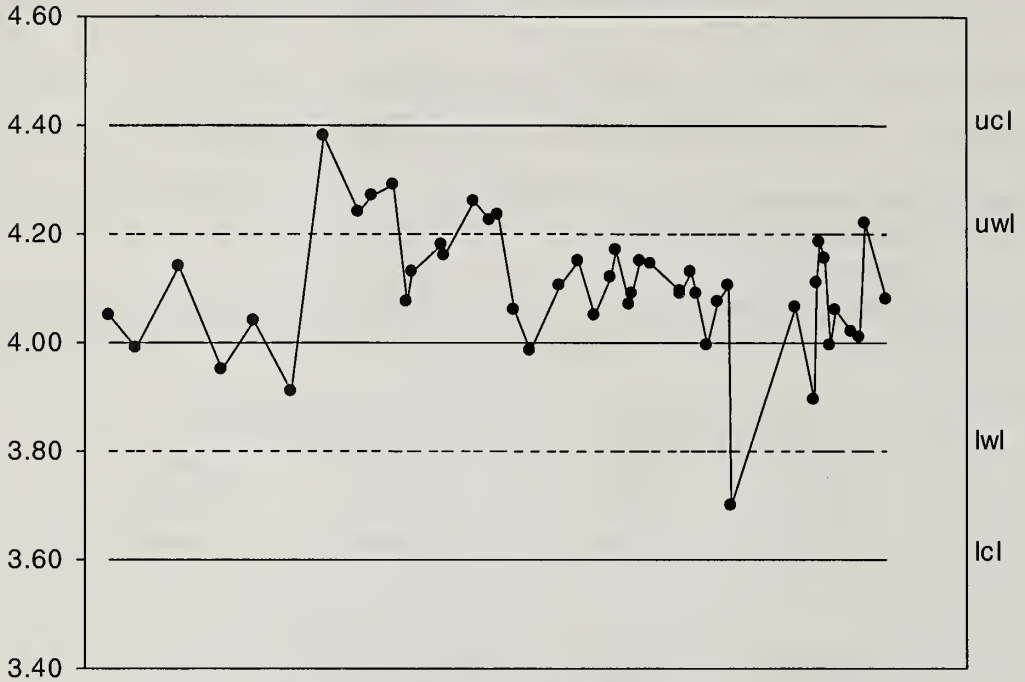
Duplicates

Number	Concentration	Std. Dev.	% Coeff of Var
45	0 - 5.0	0.078	13.844
0	5.1 - 10.0	N/A	N/A
2	10.1 - 25.0	N/A	N/A
47	Total	0.132	11.740

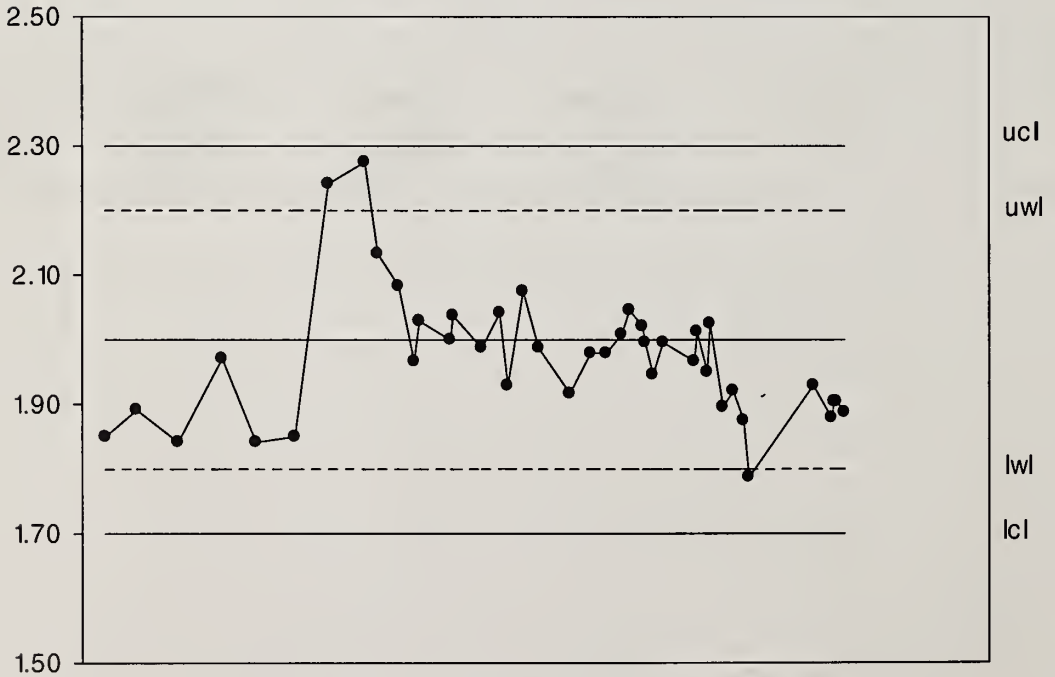
Other Checks

	Number	Expected	Mean	Mean Bias	Std. Dev.
LTB	47	0.000	0.0117	0.0117	0.015
FB	47	0.000	0.0149	0.0149	0.017

Chlorophyll "A" (E3169)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 4.00 µg/L



Quality Control Standard A + B



Quality Control Standard A - B

Chlorophyll "A" Acidified, (E3169)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 4.00 µg/L

Calibration Control

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	48	2.40	2.554	0.154	0.142
B	48	0.80	0.864	0.064	0.081
A + B		3.20	3.419	0.219	1.271
A - B		1.60	1.690	0.090	0.630

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.116
	Within Runs	0.446
	Between/Within	0.260

Control Limits

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	3.600	2.800	4.000	2.400
A - B	2.000	1.200	2.200	1.000

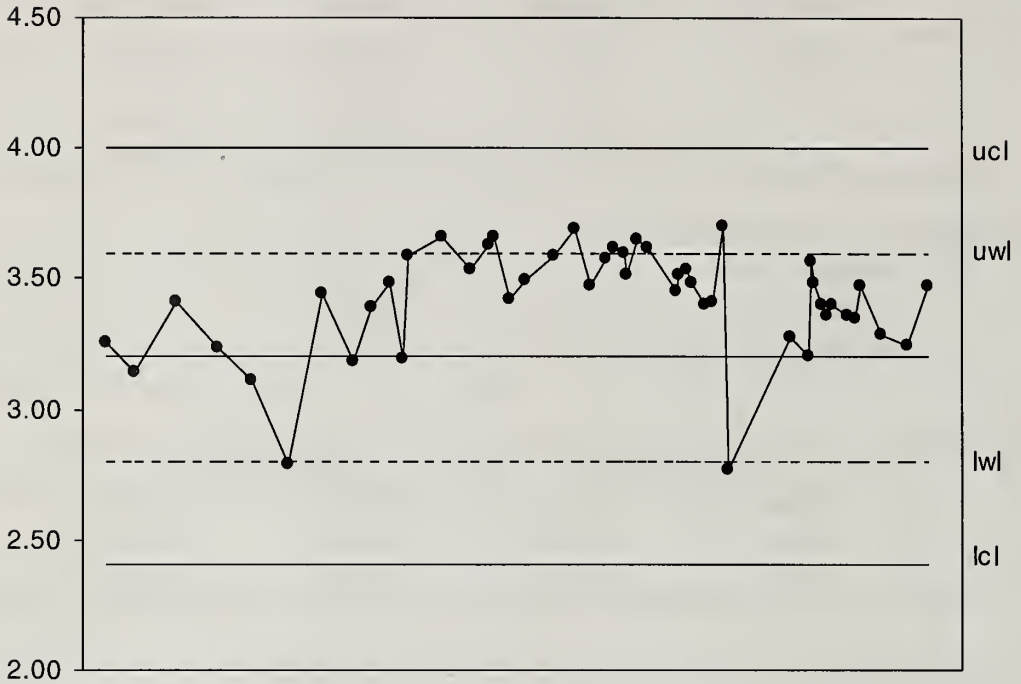
Duplicates

Number	Concentration	Std. Dev.	% Coeff of Var
27	-0.5 - 1.0	0.171	96.104
3	1.1 - 2.0	0.236	19.361
2	2.1 - 5.0	N/A	N/A
1	5.1 - 10.0	N/A	N/A
2	10.1 - 100	N/A	N/A
35	Total	0.206	14.436

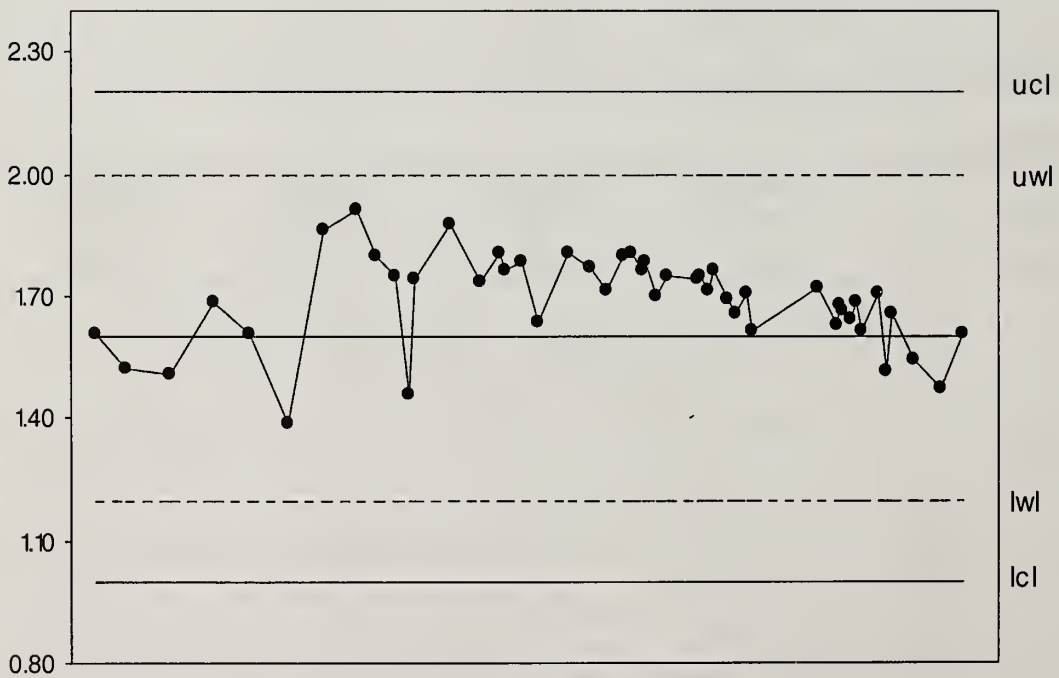
Other Checks

	Number	Expected	Mean	Mean Bias	Std. Dev.
LTB	48	0.000	-0.036	-0.036	0.038
FB	48	0.000	-0.064	-0.064	0.087

Chlorophyll "A" Acidified, (E3169)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 4.00 µg/L



Quality Control Standard A + B



Quality Control Standard A - B

Chlorophyll "B" (E3169)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 4.00 µg/L

Calibration Control

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	47	3.00	2.998	-0.002	0.076
B	47	1.00	1.060	0.060	0.050
A + B		4.00	4.057	0.057	0.104
A - B		2.00	1.938	-0.062	0.076

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.064
	Within Runs	0.054
	Between/Within	1.185

Control Limits

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	4.200	3.800	4.400	3.600
A - B	2.200	1.800	2.300	1.700

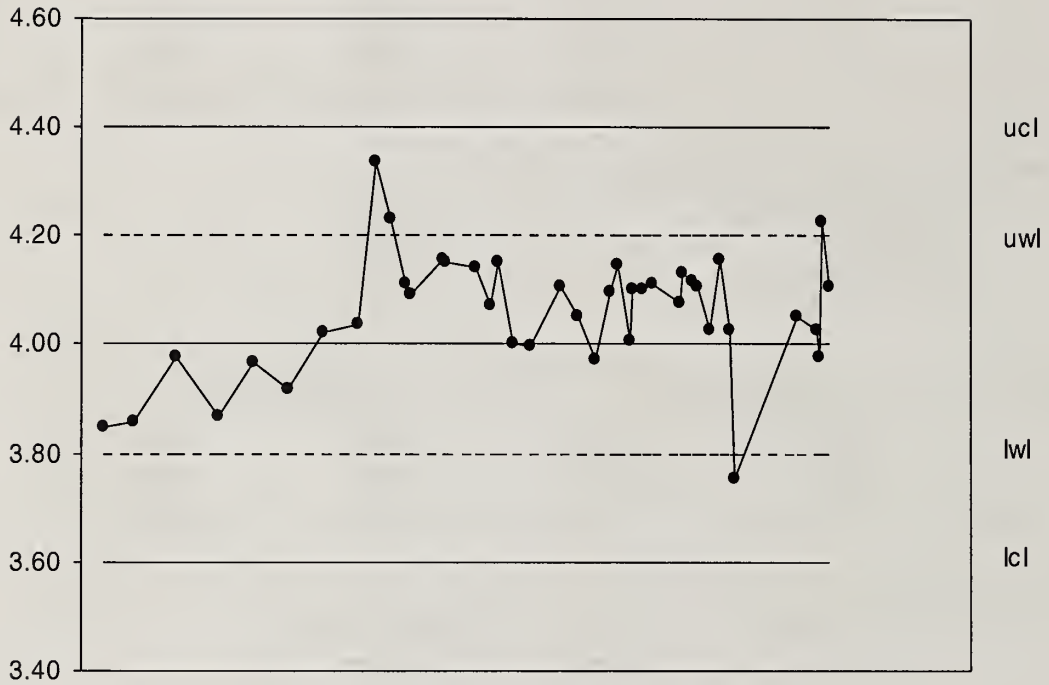
Duplicates

Number	Concentration	Std. Dev.	% Coeff of Var
37	0 - 5.0	0.035	36.417
3	5.1 - 10.0	0.233	17.624
0	10.1 - 25.0	n.a.	n.a.
41	Total	0.081	32.410

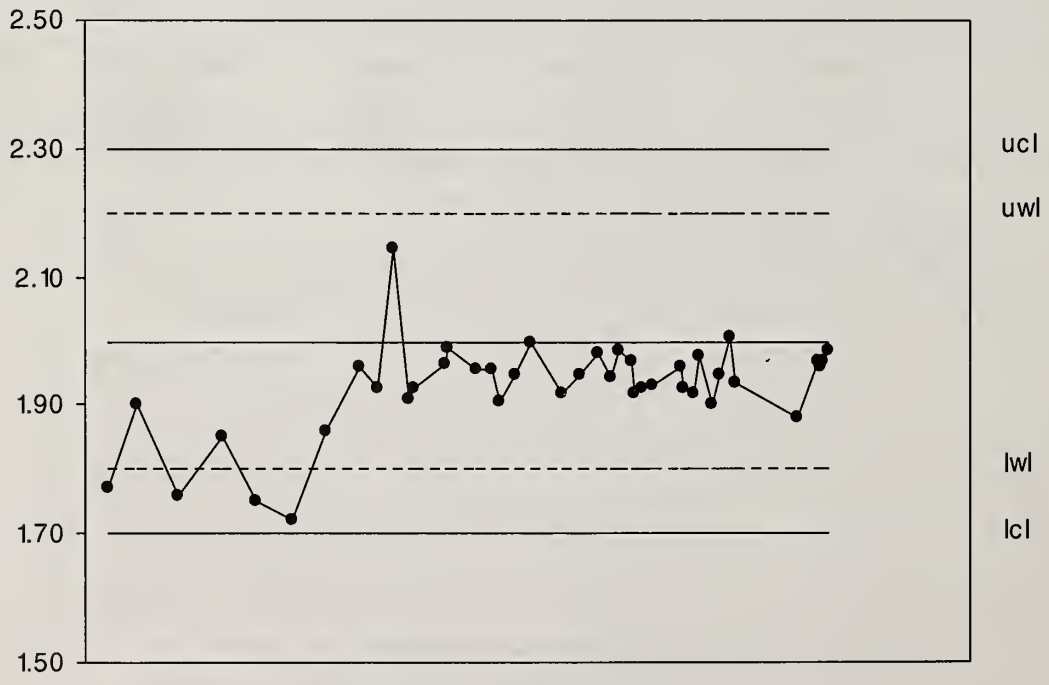
Other Checks

	Number	Expected	Mean	Mean Bias	Std. Dev.
LTB	47	0.000	0.023	0.023	0.075
FB	47	0.000	0.038	0.038	0.161

Chlorophyll "B" (E3169)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 4.00 µg/L



Quality Control Standard A + B



Quality Control Standard A - B

COLOUR, TRUE

ACCREDITATION & DRINKING-WATER LICENSING STATUS

ACCREDITED ☑	Licensed (Drinking Water) ☑
	Drinking Water Standard (SDWA): N/A

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	13/03/84
Method Reference No.	E3219	Reporting Unit	TCU
LIMS Product Code	COL3219	Supervisor	P. Wilson
Sample Type/Matrix	Effluent, Industrial Waste, Drinking Water, Ground Water, Leachate, Precipitation, Surface Water		

SAMPLING:

Quantity Required	50 mL
Container	Glass or plastic
Preservative(s)	None

ANALYTICAL PROCEDURE:

True colour is measured colourimetrically on the supernatant of a settled sample in a system calibrated with acidified chloroplatinate standards. The sample stream is measured using a broadband blue filter. Residual turbidity effects are suppressed by using a broadband red filter and increased path length in the reference stream. Approximate absorbance: 0.3 at the full scale level.

INSTRUMENTATION:

Basic automated modular continuous flow system. Colour measurement is through a 3.0 cm. light path using a broadband filter (405-450 nm). Turbidity measurement is through a 5.0 cm. light path using a different broadband filter (660-740 nm). Data capture and processing is via a computer system.

REPORTING:

Max. Significant Figures: 3	Current W value: 0.2	Current T value: 1.0	Full Scale: 100 TCU

CALIBRATION:

BL plus 6 standards

CONTROLS:

Calibration	LTBL plus 2 standards, e.g. QCA, QCB, QCC
Drift	BL, Drift control(s) and standard after every 10 samples

Colour; True (E3219)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 100.0 TCU

Calibration Control

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	57	70	70.561	0.561	0.342
B	57	25	25.36	0.36	0.327
C	57	7.5	7.021	0.479	0.277
A + B		95	95.921	0.921	0.558
A - B		45	45.202	0.202	0.369
B + C		32.5	32.381	0.119	0.536
B - C		17.5	18.339	0.839	0.283

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.334
	Within Runs	0.261
	Between/Within	1.28
s.d.(BC)	Between Runs	0.303
	Within Runs	0.2
	Between/Within	1.515

Control Limits

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	96.110	93.590	97.820	92.180
A - B	46.460	43.590	47.110	42.890
B + C	33.430	31.570	34.350	30.650
B - C	18.430	16.520	18.890	16.110

Duplicates

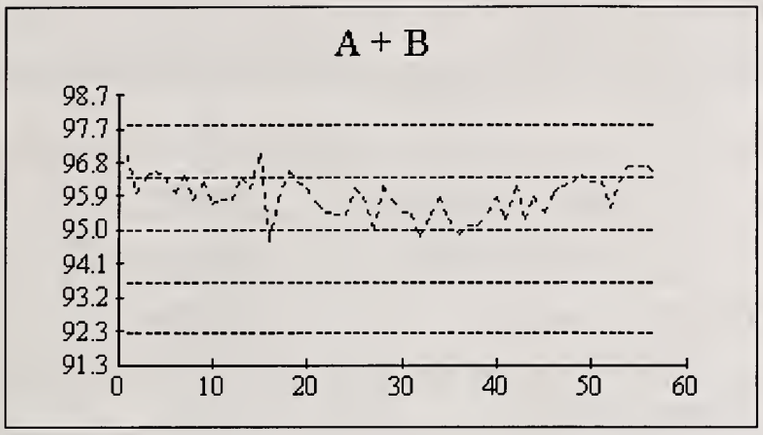
Number	Concentration	Std. Dev.	% Coeff of Var
72	0 - 10%	0.333	13.109
26	10 - 20%	0.715	4.683
27	20 - 50%	0.887	2.965
19	50 - 100%	1.581	2.535
144	Total	0.791	4.428

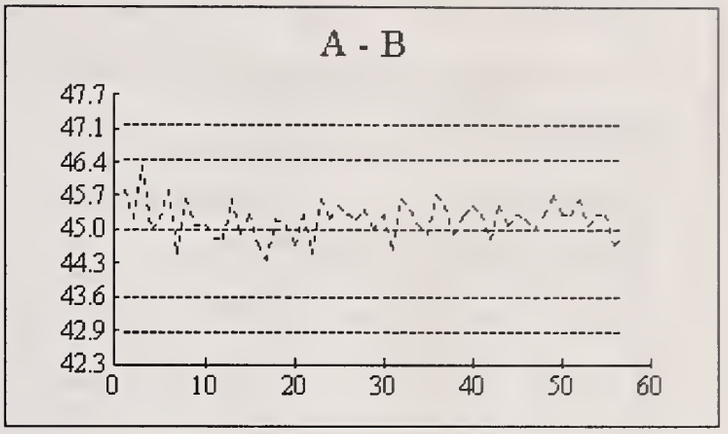
Other Checks

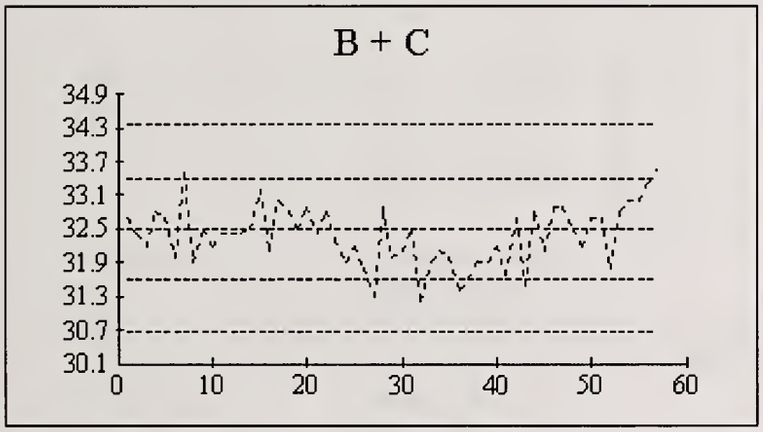
	Number	Mean	Std. Dev.
LTB	57	-0.621	0.464

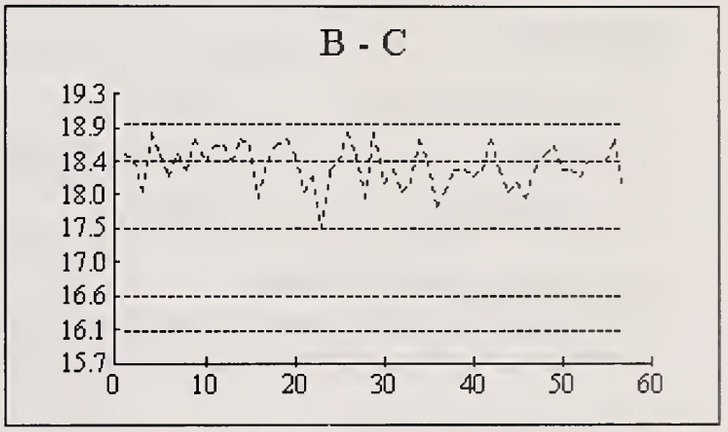
Colour;true (E3219)

QC Data; 1/1/2008 to 12/31/2008









CONDUCTIVITY

ACCREDITATION & DRINKING-WATER LICENSING STATUS

ACCREDITED ☑	Licensed (Drinking Water) ☑
	Drinking Water Standard (SDWA): N/A

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced:	01/04/74
Method Reference No:	E3218	Reporting Units:	µS/cm at 25^{0}C
LIMS Product Code:	PHALCO3218,CONDPH3218	Supervisor:	P. Wilson
Sample Type/Matrix:	Sludge, Effluent, Industrial Waste, Raw Sewage, Drinking Water, Ground Water, Leachate, Precipitation, Surface Water		

SAMPLING:

Quantity Required:	50 mL
Container:	Glass or plastic
Preservative(s)	None

ANALYTICAL PROCEDURE:

After equilibration at room temperature, the conductivity of the sample is measured. Total fixed endpoint alkalinity and pH are determined simultaneously.

INSTRUMENTATION:

Automated modular continual flow conductivity system comprising of a sampler and conductivity meter with cell plus computer control and data processing software.

REPORTING:

Max. Significant Figures:	Current W value:	Current T value:	Full Scale:
3	1	5	2000 µS/cm

CONTROLS:

Calibration:	LTBL plus 4 standards, e.g. QCA, QCB, QCC, QCD
Drift:	In run standards throughout the run (tap water diluted to 50% V/V)

Conductivity (E3218)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 2000.00 µS/cm

Calibration Control

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	118	1413.00	1412.243	-0.757	4.125
B	118	717.80	718.410	0.410	2.632
C	118	147.00	147.376	0.376	0.822
D	118	37.10	37.535	0.435	0.520
A + B	118	2130.80	2130.605	-0.395	5.101
A - B		695.20	693.870	-1.130	4.681
B + C		864.80	865.748	0.748	2.886
B - C		570.80	570.987	-0.013	2.666
C + D		184.10	184.923	0.823	1.039
C - D		109.90	109.839	-0.061	0.893

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	3.460
	Within Runs	3.310
	Between/Within	1.045
s.d.(BC)	Between Runs	1.950
	Within Runs	1.885
	Between/Within	1.034
s.d.(CD)	Between Runs	0.688
	Within Runs	0.632
	Between/Within	1.089

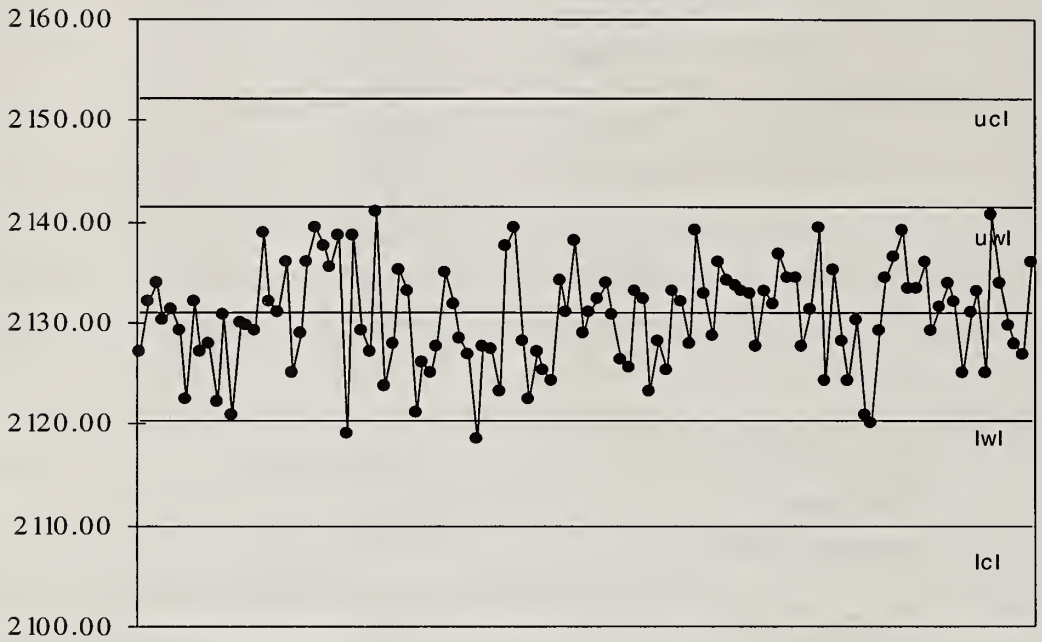
Control Limits

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	2141.6	2120.4	2152.200	2109.800
A - B	705.6	684.4	710.900	679.100
B + C	871.6	858.4	878.100	851.900
B - C	577.6	564.4	580.800	561.200
C + D	186.13	182.07	188.160	180.040
C - D	111.93	107.87	112.940	106.860

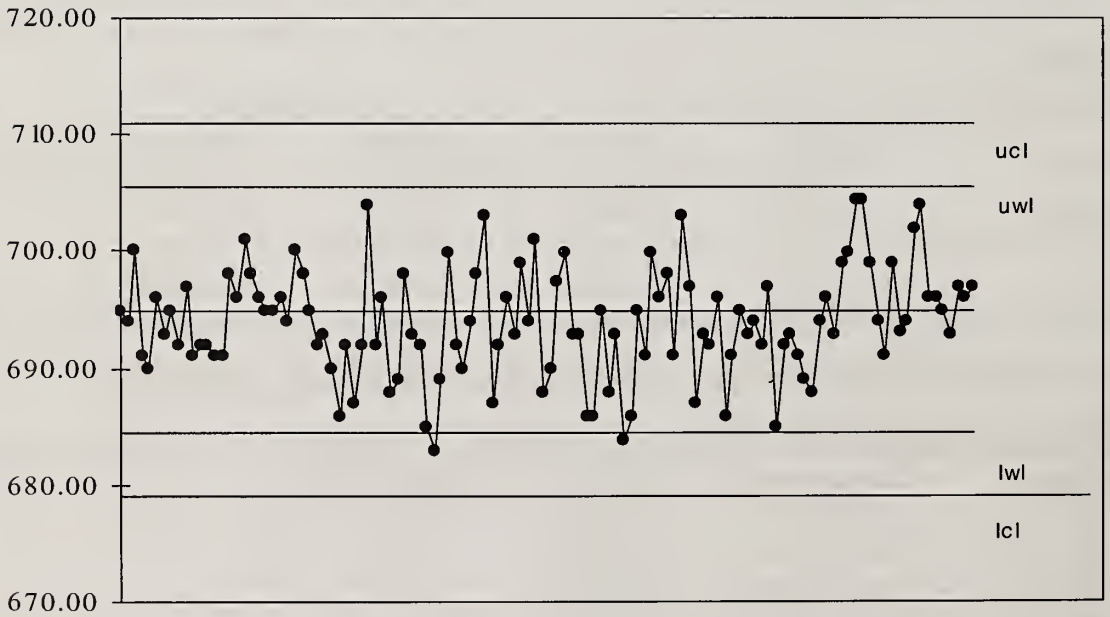
Duplicates

Number	Concentration	Std. Dev.	% Coeff of Var
59	0 - 200	1.0283	1.1
126	201 - 400	2.5255	0.8
125	401 - 1000	4.8341	0.8
n/a	1001 - 2000	n/a	n/a
9	2001 - 10000	79.3049	2.0
336	Total	2.5800	13.6

Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 2000.00 µS/cm

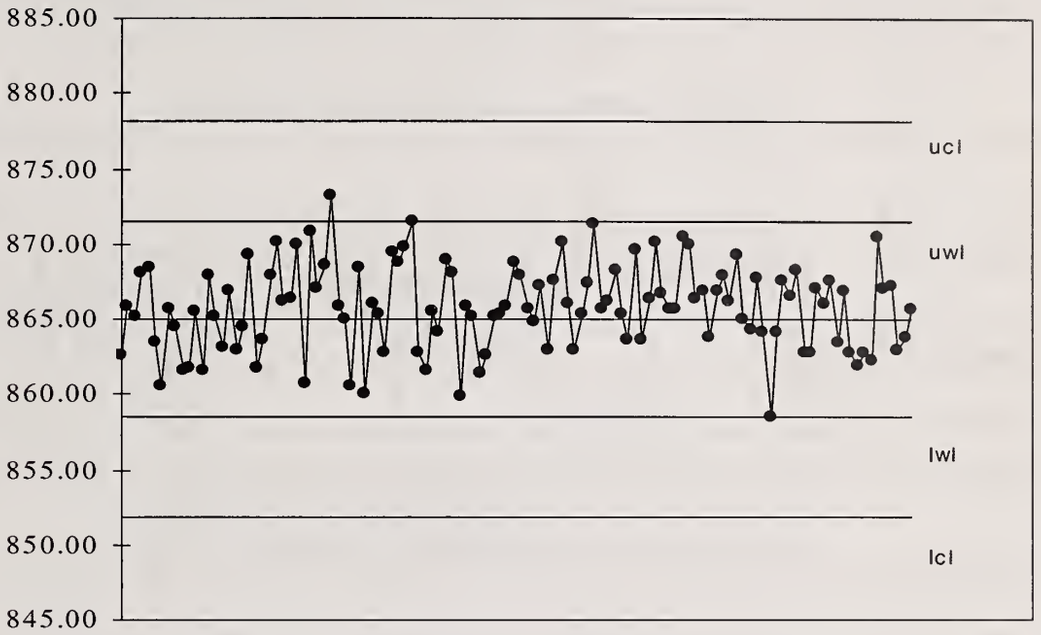


Quality Control Standard A + B

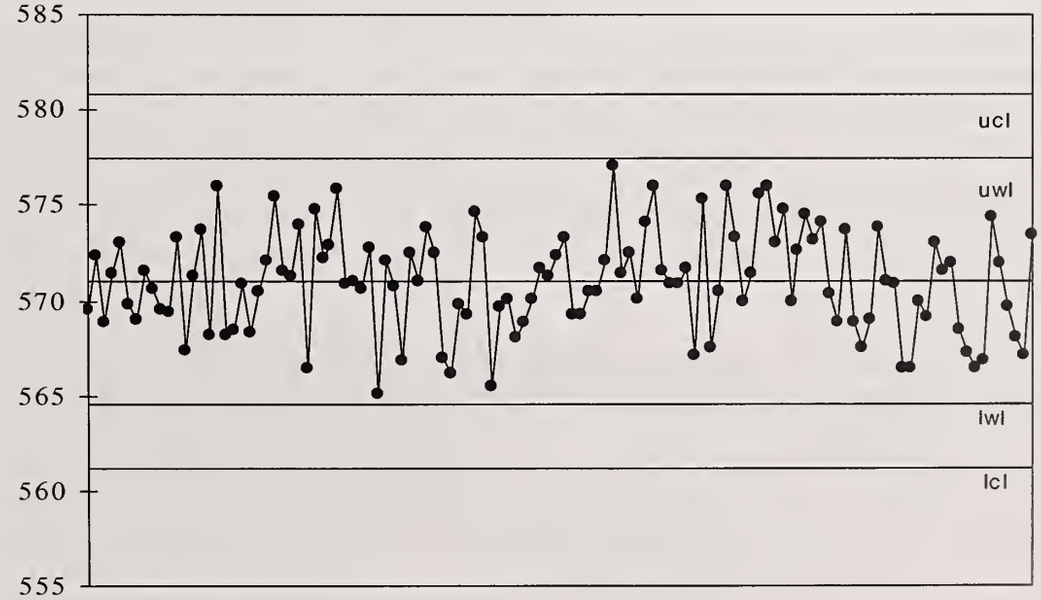


Quality Control Standard A - B

Conductivity (E3218)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 2000.00 µS/cm



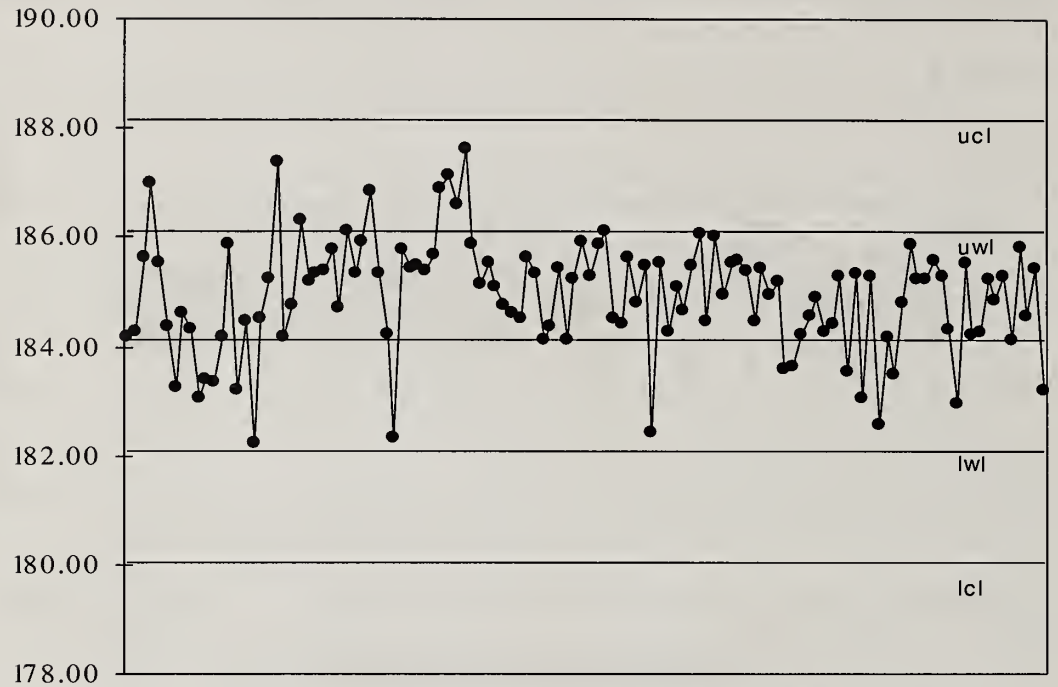
Quality Control Standard B + C



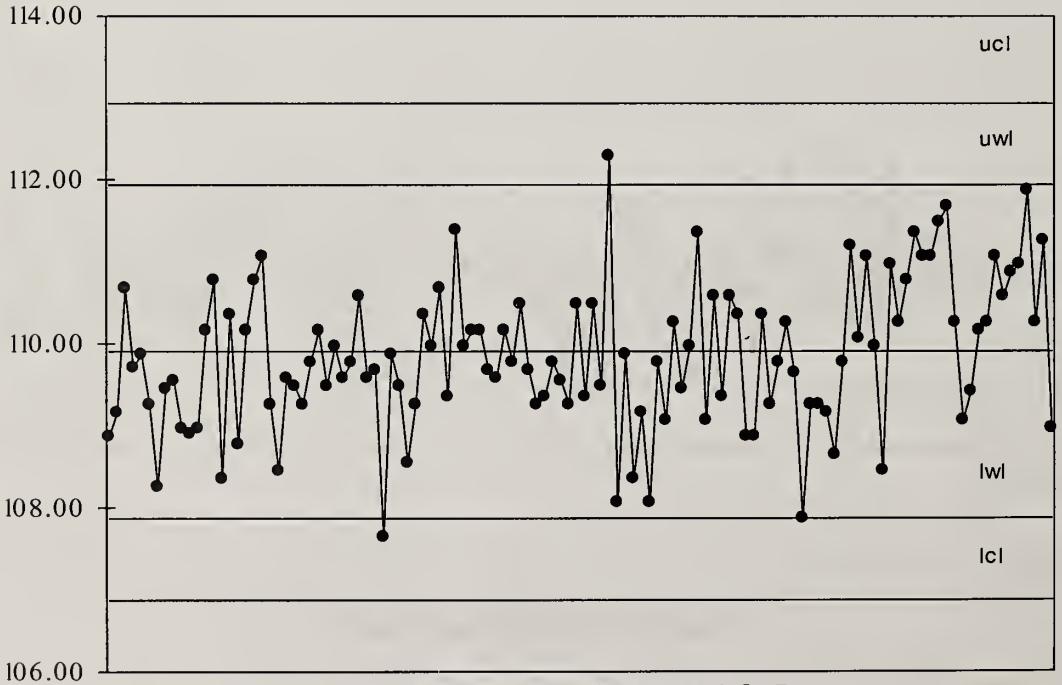
Quality Control Standard B - C

Conductivity (E3218)

Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 2000.00 µS/cm



Quality Control Standard C+D



Quality Control Standard C- D

CYANIDE, FREE

ACCREDITATION & DRINKING-WATER LICENSING STATUS

ACCREDITED ☑	Licensed (Drinking Water) ☑
	Drinking Water Standard (SDWA): 0.2 mg/L

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/01/98
Method Reference No.	E3015	Reporting Unit	Aqueous: mg/L as CN Solid: µg/g as CN
LIMS Product Code	CNF3015	Supervisor	P. Wilson
Sample Type/Matrix	**Aqueous:** Surface Water, Drinking Water, Ground Water, Raw Sewage & Effluent, Industrial Effluent. **Solid:** Sediment, Dried Sludge, Industrial Waste		

SAMPLING:

Quantity Required:	**Aqueous**: 500 mL + 10 drops of 50% w/v NaOH **Solid** : 5 g, minimum
Container:	Glass or plastic
Preservative(s)	None

ANALYTICAL PROCEDURE:

Free cyanides are the simple and weakly dissociable cyanides which form HCN upon acidification to pH4.0 (such as HCN and KCN). The automated determination of free cyanide exposes the sample to distillation which isolates HCN under specific acidic conditions. A zinc sulphate solution is included which eliminates interference from complexed iron cyanides. Cyanide is determined colourimetrically by the reaction of cyanide with chloramine –T to form cyanogen chloride which further reacts with a combination of barbituric acid and isonicotinic acid to form a highly coloured coupling product, which is measured at 600 nm.

Aqueous samples are introduced directly to the continuous flow system by an auto sampler.
Solid samples are extracted in a sodium hydroxide solution with mechanical shaking for 6 to 8 hours and then centrifuged. The supernatant is decanted, diluted if necessary to eliminate interference from colour and introduced to the continuous flow system by the auto sampler. Solid samples are not dried or ground, but weighed and extracted as received, to prevent the loss of simple cyanides. If the sample is wet, results are reported as µg/g wet and moisture content is reported by a separate method.

CYANIDE, FREE cont'd

INSTRUMENTATION:

Skalar automated segmented flow colourimetric system, measurement through a 500 mm light path at 600nm.
Skalar data capture and data processing software with computer system.

REPORTING:

Max. Significant Figures:	Current W value:	Current T value:	Full Scale:
3	0.001 mg/L 0.01 µg/g	0.005mg/L 0.05 µg/g	0.2 mg/L

CALIBRATION:

BL plus 6 standards (S0 to S5)

CONTROLS:

Calibration:	LTB plus 2 standards , e.g. QCA, QCB
Drift:	BL , Drift Control(s), and check standards

Cyanide, Free (E3015)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 0.200 mg/L as CN^-

Calibration Control

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	5	0.150	0.149	-0.001	0.002
B	5	0.020	0.019	-0.001	0.001
A + B		0.170	0.168	-0.002	0.004
A - B		0.130	0.130	0	0.002

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.0020
	Within Runs	0.0012
	Between/Within	1.667

Control Limits

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	0.178	0.162	0.186	0.154
A - B	0.138	0.122	0.142	0.118

Duplicates

Aqueous Samples

Number	Concentration	Std. Dev.	% Coeff of Var
11	0 - 0.020	0.0001	11.059
0	0.021 - 0.040	n/a	n/a
0	0.041 - 0.100	n/a	n/a
0	0.101 - 0.200	n/a	n/a
11	Total	0.0001	11.059

Soil Samples

Number	Concentration	Std. Dev.	% Coeff of Var
0	0 - 0.020	N/A	N/A
0	0.021 - 0.040	N/A	N/A
0	0.041 - 0.100	N/A	N/A
0	0.101 - 0.200	N/A	N/A
0	Total	N/A	

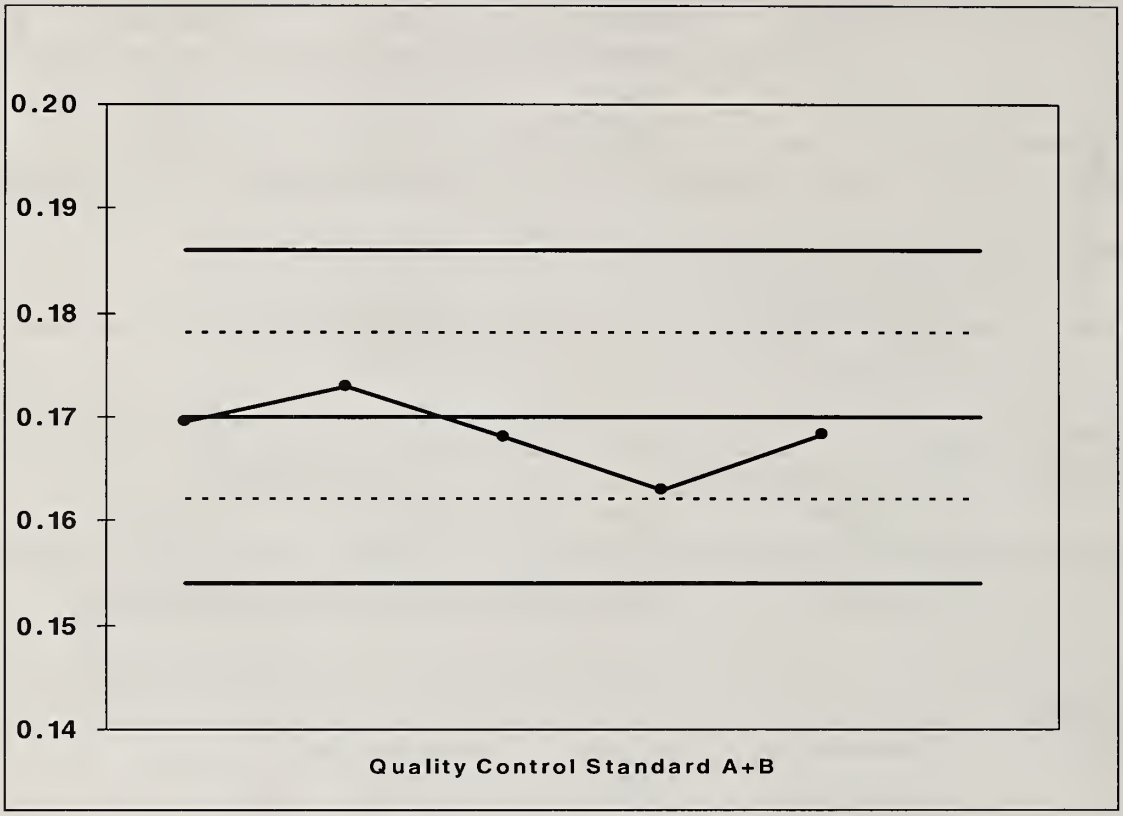
Check Standards

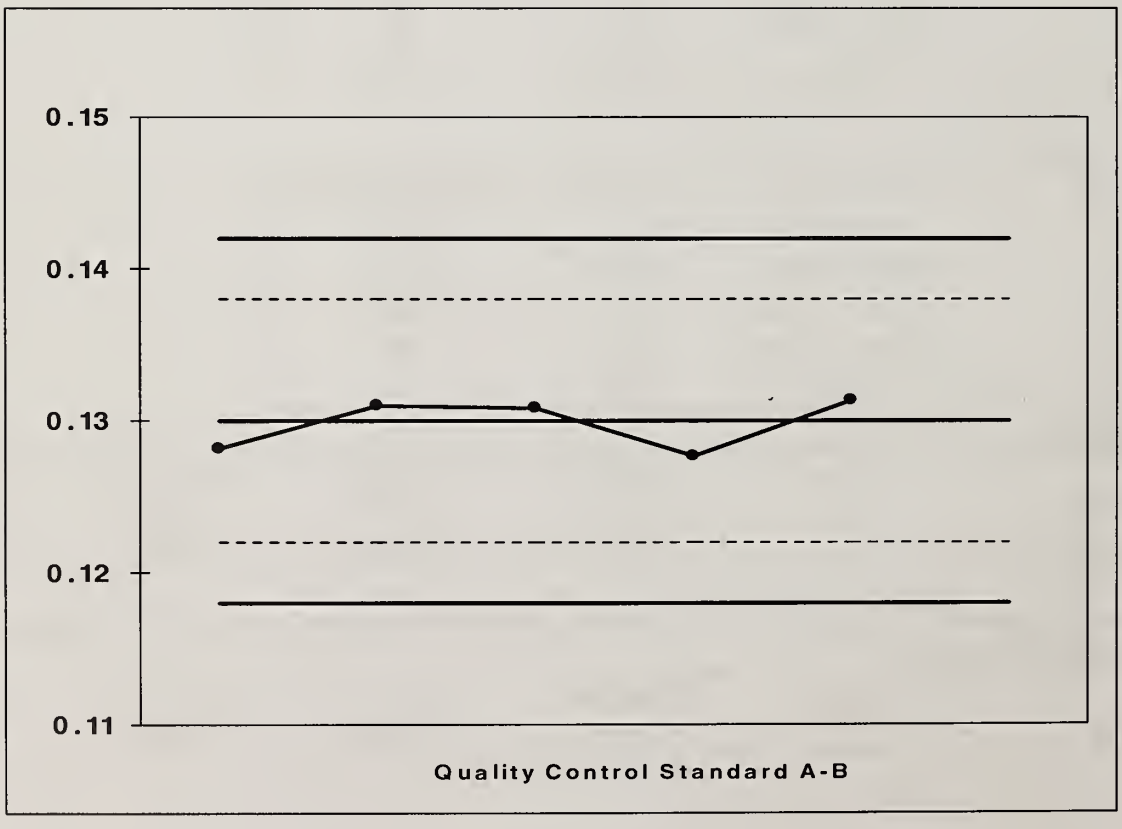
	Number	Expected	Mean	Mean Bias	Std. Dev.
Cert KCN	5	0.100	0.097	-0.003	0.003
Cert FeCN	5	<0.001*	0.005	-0.095	0.010

Note:
* FeCN is not expected to be detected for free cyanide. Results should be <= w or <0.001 although standard tested is 0.10 mg/L.

	Number	Expected	Mean	Mean Bias	Std. Dev.
LTB	5	0.0000	0.0002	0.0002	0.0003

Cyanide, Free (E3015)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 0.200 mg/L as CN^-





CYANIDE, TOTAL

ACCREDITATION & DRINKING-WATER LICENSING STATUS

ACCREDITED ☑	Licensed (Drinking Water) ☑
	Drinking Water Standard (SDWA): N/A

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/01/98
Method Reference No.	E3015	Reporting Unit	Aqueous: mg/L as CN Solid: µg/g as CN
LIMS Product Code	CN3015, TCLPCN3015	Supervisor	P. Wilson
Sample Type/Matrix	**Aqueous:** Surface Water, Drinking Water, Ground Water, Raw Sewage & Effluent, and Industrial Effluent. **Solid:** Soil, Sediment, Dried Sludge, Industrial Waste		

SAMPLING:

Quantity Required:	Aqueous: 500 mL + 10 drops of 50% w/v NaOH **Solid** : 5 g, minimum
Container:	Glass or plastic
Preservative(s)	None

ANALYTICAL PROCEDURE:

Total cyanides include free, simple (HCN,KCN) and weakly dissociable cyanides ($Ni(CN)_4$) as well as those complexed cyanides that decompose to form free cyanides that distil out as HCN in an acidic environment. The automated determination of total cyanide exposes the sample to ultraviolet radiation to break down organic metallic and alkali-complexed cyanide compounds to free cyanide. The distillation step isolates HCN under specific acidic conditions. The sequential combination of UV digestion plus distillation yields the measurement of "total cyanide". Cyanide is measured colourimetrically by the reaction of cyanide with chloramine –T to form cyanogen chloride which further reacts with a combination of barbituric acid and isonicotinic acid to form a highly coloured coupling product, which is measured at 600 nm.

Aqueous samples are introduced directly to the continuous flow system from an auto sampler.
Solid samples are extracted in a sodium hydroxide solution with mechanical shaking for 6 to 8 hours, and then centrifuged. The supernatant is then decanted, diluted if necessary to eliminate interference from colour and introduced to the continuous flow system by the auto sampler. Solid samples are not dried or ground, but weighed and extracted as received, to prevent the loss of simple cyanides. If the sample is wet, results are reported as µg/g wet and moisture content is reported by a separate method.

INSTRUMENTATION:

Skalar automated segmented flow colourimetric system, measurement through a 500 mm light path at 600 nm. Skalar data capture and data processing software with computer system.

CYANIDE, TOTAL cont'd

REPORTING:

Max. Significant Figures:	Current W value:	Current T value:	Full Scale:
3	0.001 mg/L 0.01 µg/g	0.005mg/L 0.05 µg/g	0.2 mg/L

CALIBRATION:

BL plus 6 standards (S0 to S5)

CONTROLS:

Calibration:	LTB plus 2 standards , e.g. QCA, QCB
Drift:	BL, Drift Control(s), and check standards

Cyanide, Total (E3015)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 0.200 mg/L as CN^-

Calibration Control

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	21	0.150	0.149	-0.001	0.002
B	21	0.020	0.019	-0.001	0.001
A + B		0.170	0.168	-0.002	0.002
A - B		0.130	0.130	0.000	0.002

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.0016
	Within Runs	0.0014
	Between/Within	1.1429

Control Limits

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	0.178	0.162	0.186	0.154
A - B	0.138	0.122	0.142	0.118

Duplicates

Aqueous Samples

Number	Concentration	Std. Dev.	% Coeff of Var
34	0 – 0.020	0.0002	6.0750
n/a	0.021 – 0.040	n/a	n/a
9	0.041 – 0.100	0.0020	2.5753
6	0.101 – 0.200	0.0011	0.7430
48	Total	0.0009	6.0750

Soil Samples

Number	Concentration	Std. Dev.	% Coeff of Var
0	0 – 0.020	N/A	N/A
0	0.021 – 0.040	N/A	N/A
0	0.041 – 0.100	N/A	N/A
0	0.101 – 0.200	N/A	N/A
0	Total	N/A	N/A

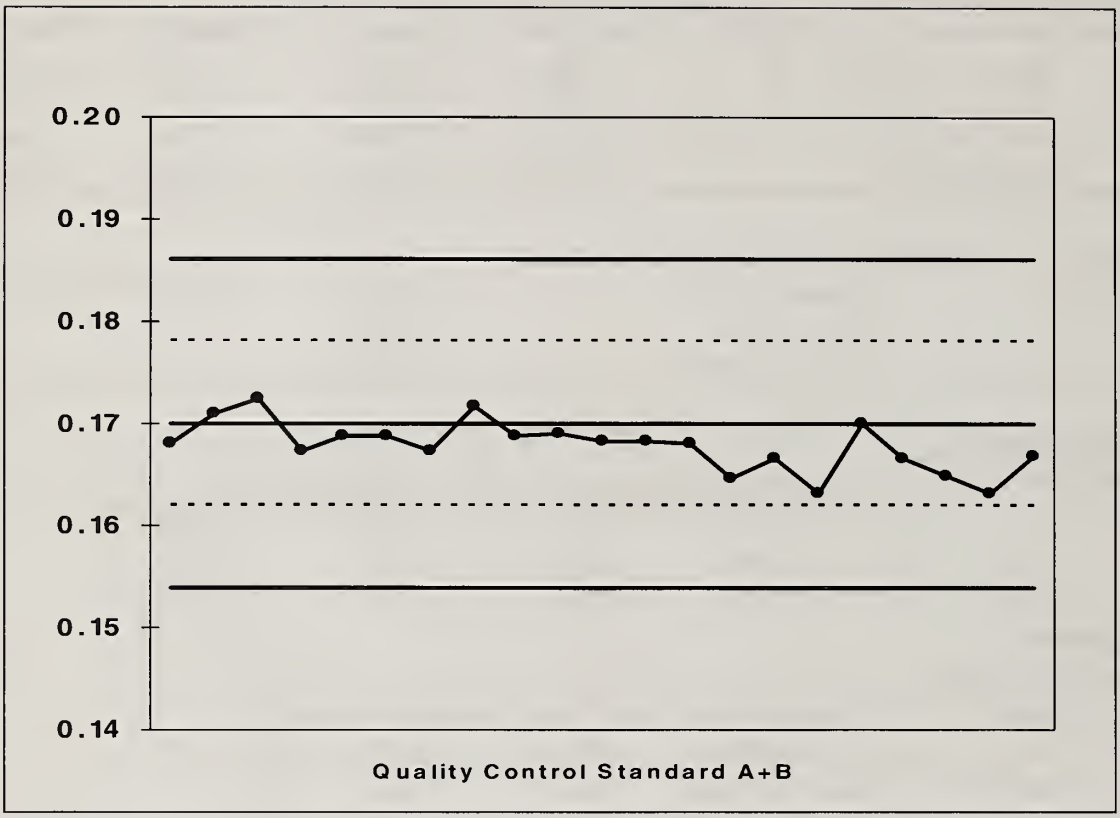
Check Standards

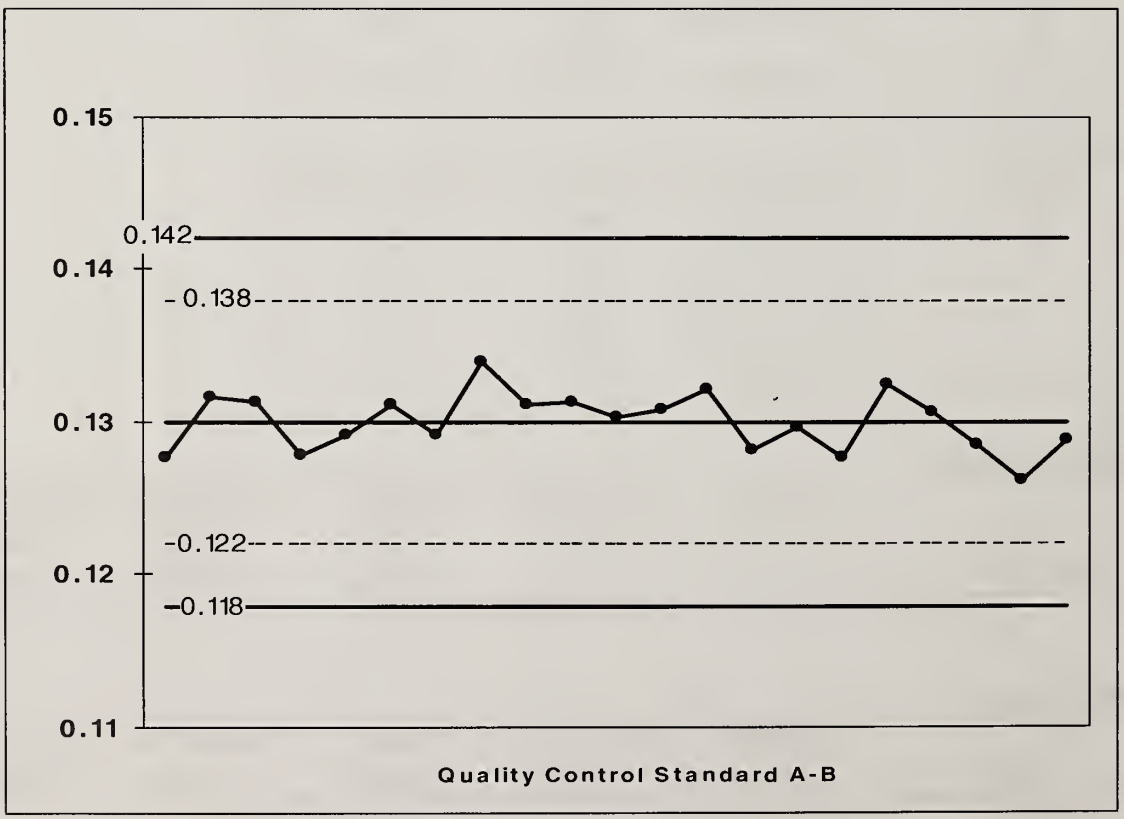
	Number	Expected	Mean	Mean Bias	Std. Dev.
Cert KCN	21	0.100	0.098	-0.002	0.002
Cert FeCN	21	0.100	0.136	0.036	0.189

Other Checks

	Number	Expected	Mean	Mean Bias	Std. Dev.
LTB	21	0.0000	-0.0001	-0.0001	0.0004

Cyanide, Total (E3015)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 0.200 mg/L as CN^-





FLUORIDE

ACCREDITATION & DRINKING-WATER LICENSING STATUS

ACCREDITED ☑	Licensed (Drinking Water) ☑
	Drinking Water Standard (SDWA): 1.5 mg/L

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	October 2001
Method Reference No	E3172	Reporting Unit	mg/L as F
LIMS Product Code	F3172, ANION3172, TCLPF3172	Supervisor	P. WILSON
Sample Type/Matrix	Effluent, Industrial Waste, Process Water, Drinking Water, Ground Water, Leachate, Surface Water, Raw Sewage, Sediment, Dried Sludge, Unknown Material, Soil		

SAMPLING:

Quantity Required	50 mL
Container	Plastic
Preservative(s)	None

ANALYTICAL PROCEDURE:

Fluoride is separated from other anions in the samples by automated suppressed ion chromatography using an eluent mixture of 0.0010 M sodium bicarbonate and 0.0035 M sodium carbonate with conductivity detector. The concentration of fluoride in mg/L as F^- is determined by comparison of the sample scan to a series of standard scans.

INSTRUMENTATION:

Basic modular continuous flow ion chromatographic system consisting of a Chromeleon Chromatography Management System, Autosampler with Chromatography Compartment, Pump, Conductivity Detector, Eluent Suppression Systems using an Anion Self Regenerating Suppressor, and Guard and Separator Columns.

REPORTING:

Max. Significant Figures: 3	Current W value: 0.01	Current T value: 0.05	Full Scale: 2.0 mg/L

CALIBRATION:

BL plus 9 standards

CONTROLS:

Calibration	LTB plus 3 standards, e.g. QCA, QCB, QCC
Drift	CHK1 and CHK2 standard approximately every 18 samples

Fluoride F^- (E3172)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 2.000 mg/L as F^-

Calibration Control

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	82	1.600	1.601	0.001	0.010
B	82	0.800	0.801	0.001	0.006
C	82	0.160	0.161	0.001	0.005
A + B		2.400	2.402	0.002	0.012
A - B		0.800	0.800	0.000	0.012
B + C		0.960	0.962	0.002	0.009
B - C		0.640	0.640	0.000	0.007

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.00829
	Within Runs	0.00825
	Between/Within	1.00485
s.d.(BC)	Between Runs	0.00585
	Within Runs	0.00524
	Between/Within	1.11641

Control Limits

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	2.425	2.375	2.450	2.350
A - B	0.825	0.775	0.838	0.762
B + C	0.983	0.937	1.006	0.914
B - C	0.663	0.617	0.674	0.606

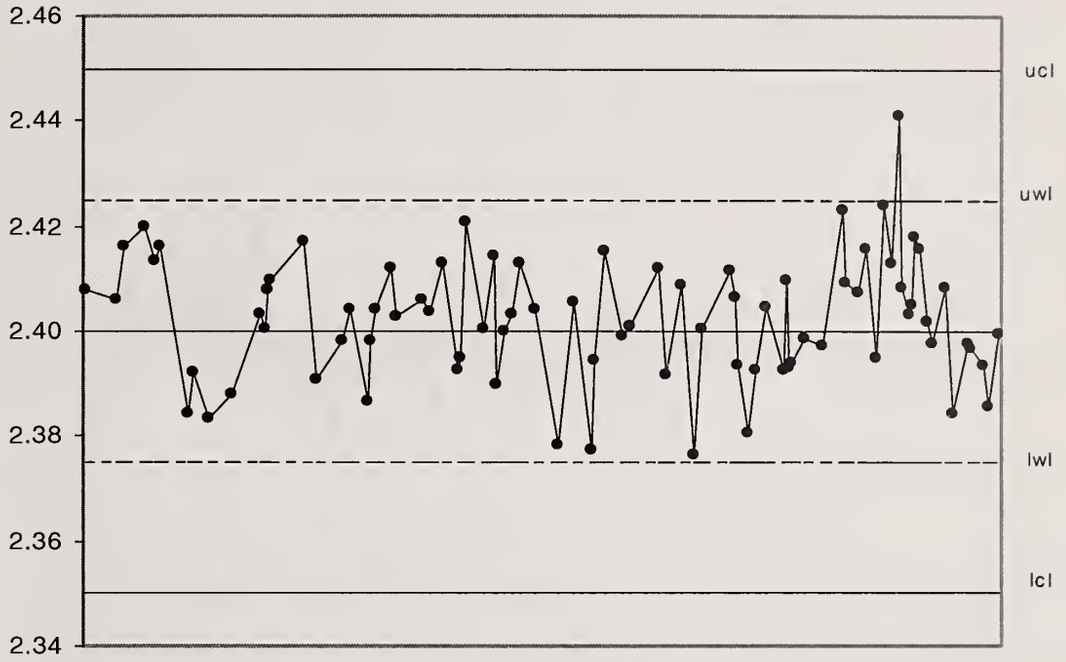
Duplicates

Number	Concentration	Std. Dev.	% Coeff of Var
104	0.000 - 0.100	0.005	8.260
64	0.100 - 0.200	0.007	5.075
21	0.200 - 0.400	0.011	3.880
40	0.400 - 1.000	0.016	2.642
11	1.000 - 2.000	0.007	0.453
240	Total	0.009	3.445

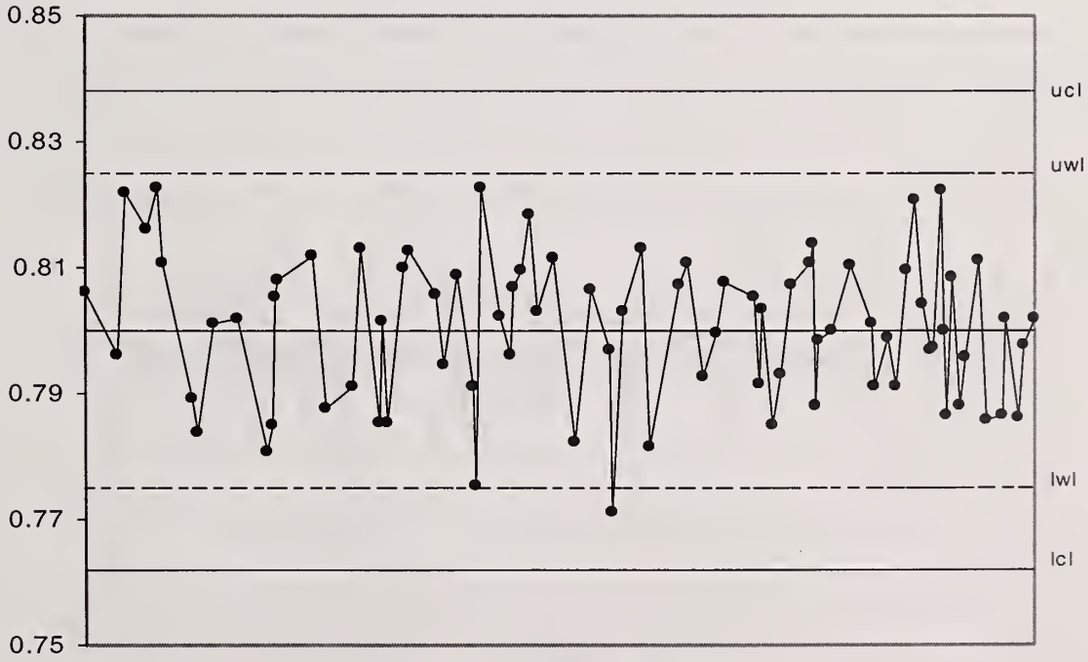
Recoveries

	Number	Expected	Mean	Mean Bias	Std. Dev.
Check Std 1	82	0.140	0.162	0.022	0.008
Check Std 2	82	1.400	1.507	0.107	0.021

Fluoride F^- (E3172)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 2.000 mg/L as F^-

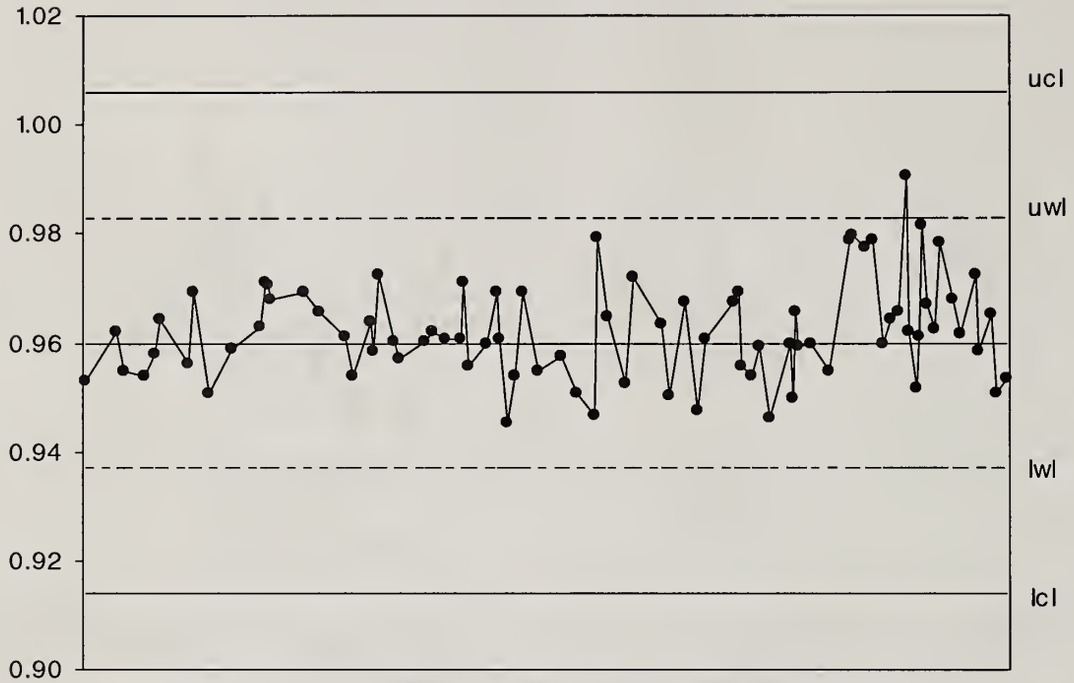


Quality Control Standard A+B

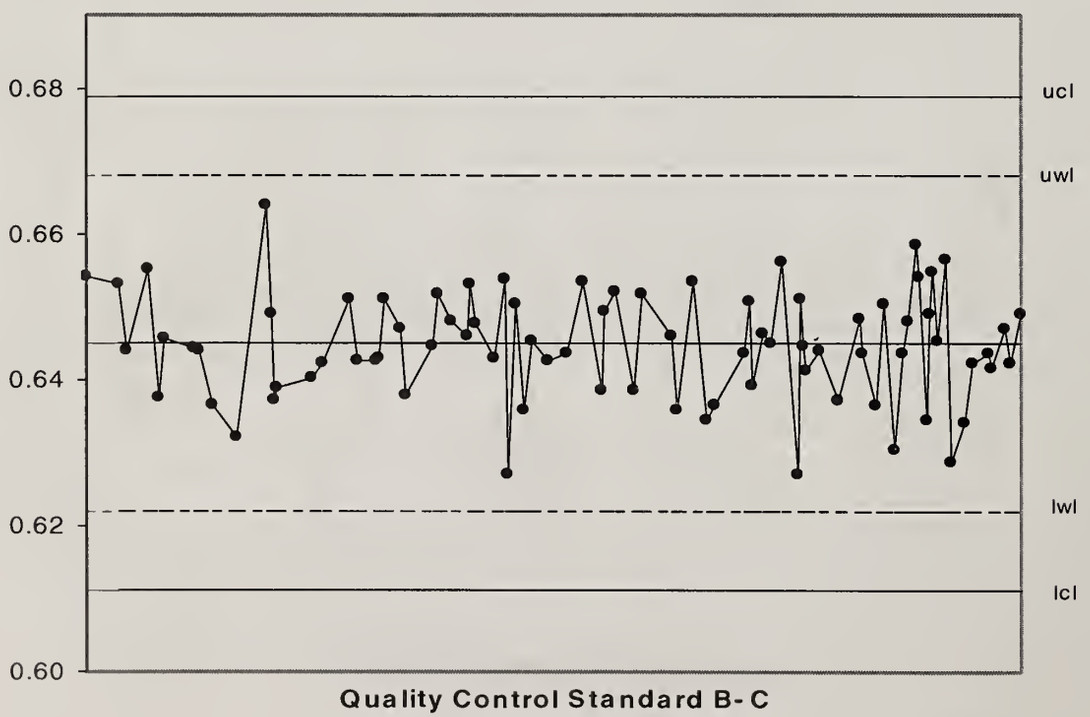


Quality Control Standard A-B

Fluoride F^- (E3172)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 2.000 mg/L as F^-

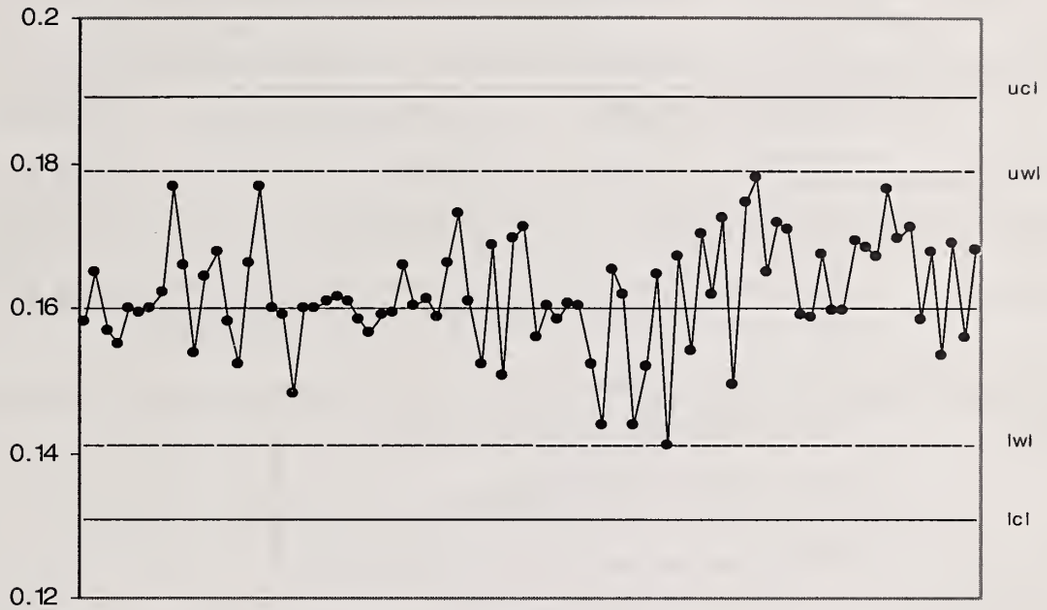


Quality Control Standard B+C

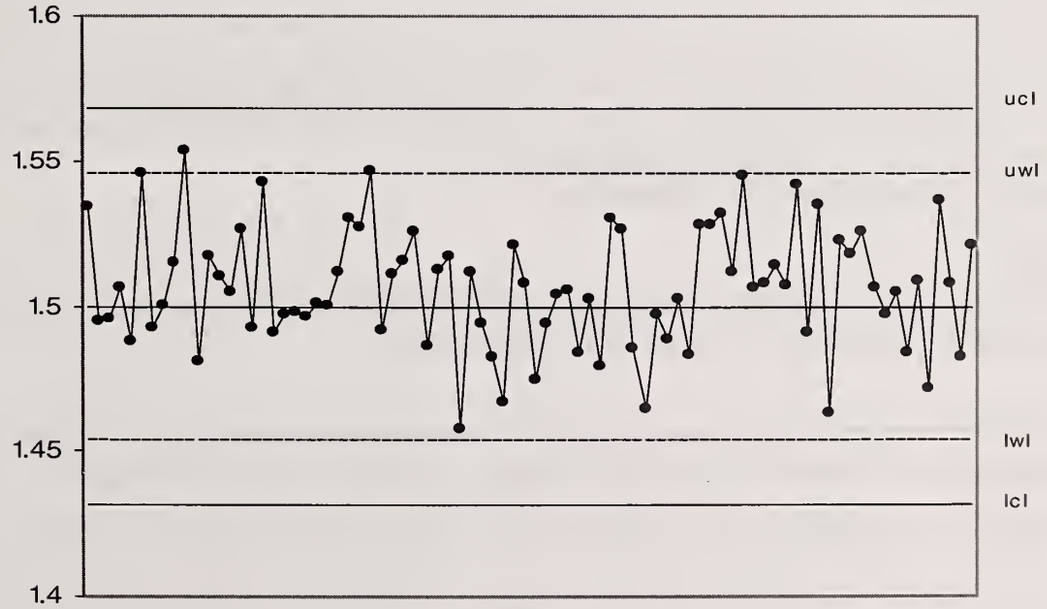


Quality Control Standard B-C

Fluoride F^- (E3172)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 2.000 mg/L as F^-



CHK1



CHK2

NITRATE

ACCREDITATION & DRINKING-WATER LICENSING STATUS

ACCREDITED ☑	Licensed (Drinking Water) N/A
	Drinking Water Standard (SDWA): N/A

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/78
Method Reference No.	E3004	Units	$\mu g/m^3$ as NO_3
LIMS Product Code	ANION3004	Supervisor	P. Wilson
Sample Type/Matrix	Air; HiVol Glass Fibre, Quartz and Polyflon, Other Filters and Puff		

SAMPLING:

Quantity Required	¾" or 1.9cm strip from 8"x10" filter
Container	50 mL polypropylene tube
Preservative(s)	None

SAMPLING PREPARATION:

A ¾" strip is cut in pieces and deposited into a 50 mL polypropylene tube. 50 mL of Pure-Water is added to the tube. The tube is placed on a horizontal shaker for approximately 1 hour. The supernatant is then filtered into a 15 mL plastic tube and analysed.

ANALYTICAL PROCEDURE:

Nitrate separated from other anions in the sample by automated suppressed ion chromatography using an eluent mixture of sodium bicarbonate and sodium carbonate and a conductivity detector. The concentration of nitrate (mg/L) is determined by the comparison of the analyte peak area count to that of a series of standards. The analyte result is corrected for the filter blank before the final calculation is made. The result is reported as $\mu g/m^3$ as NO_3.
Chloride and sulphate are determined simultaneously.

INSTRUMENTATION:

Horizontal Shaker, ion chromatographic system plus a PC with ChromPerfect software and DT2804 card for automated sample injection, timing, and data processing.

REPORTING:

Max. Significant Figures: 3	Current W value: 0.1 $\mu g/m^3$	Current T value: 0.5 $\mu g/m^3$	Full Scale: 100 mg/L

CALIBRATION:

9 standards

NITRATE cont'd

CONTROLS:

Calibration	Blank, QCA and QCB
Drift	2 standards every 20 samples
Recovery	CS4 & CS5

NOTES:

To convert unit from mg/L to $\mu g/m^3$, the final concentration of NO_3 in $\mu g/m^3$ is calculated by the following formula:

$$\text{Result (mg/L) X 50mL X (63/6.75) / air volume} = \mu g/m^3$$

Where: 63 is the area of the filter exposed and 6.75 is the sample aliquot area in square inch.

Nitrate NO_3^- (E3004)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 28.6 µg/m^3 (100.00 mg/L) as NO_3^-

Calibration Control

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	6	80.00	80.006	0.006	0.295
B	6	20.00	19.872	-0.128	0.219
A + B		100.00	99.879	-0.121	0.267
A - B		60.00	60.134	0.134	0.446

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.260
	Within Runs	0.316
	Between/Within	0.822

Control Limits

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	101.700	98.300	103.390	96.610
A - B	61.700	58.300	62.540	57.460

Duplicates: (µg/m3)

Number	Concentration	Std. Dev.	% Coeff of Var
15	0.0-2.86	0.022	4.635
3	2.89-7.15	0.021	0.441

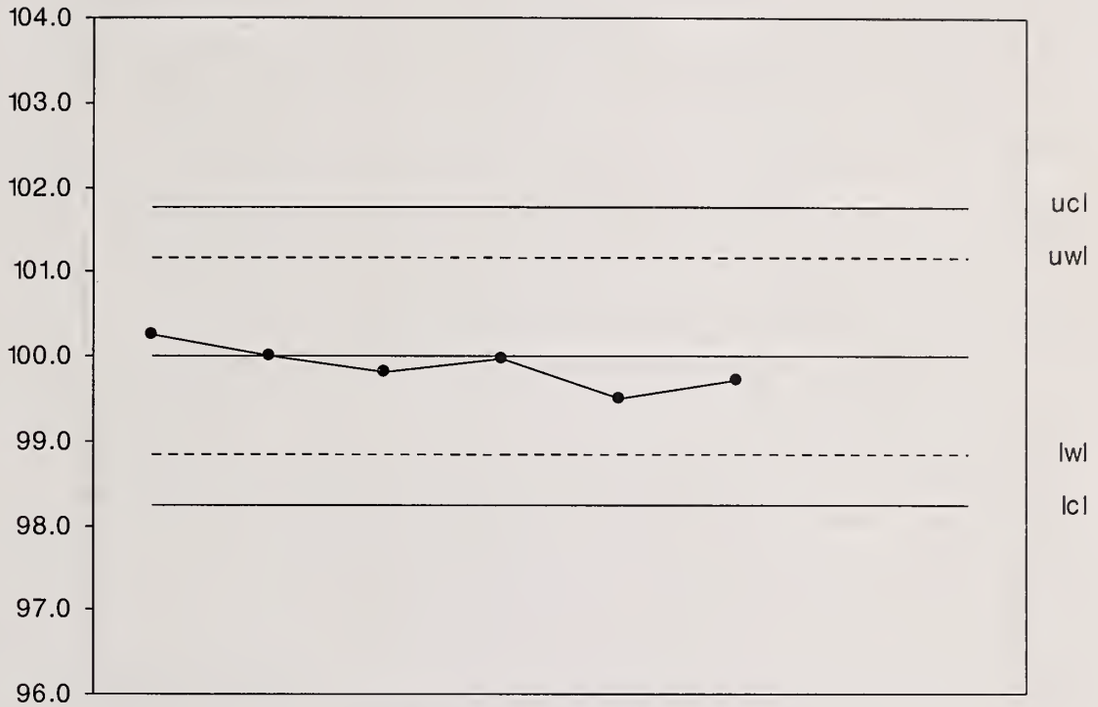
Check & Recovery Standards: (µg/m3)

	Number	Expected	Mean	Mean Bias	Std. Dev.
CS1	6	9.000	8.840	-0.160	0.137
CS2	6	90.000	89.670	-0.330	0.612
CS4	6	11.970	11.667	-0.303	0.530
CS5	6	16.190	16.217	0.097	0.256

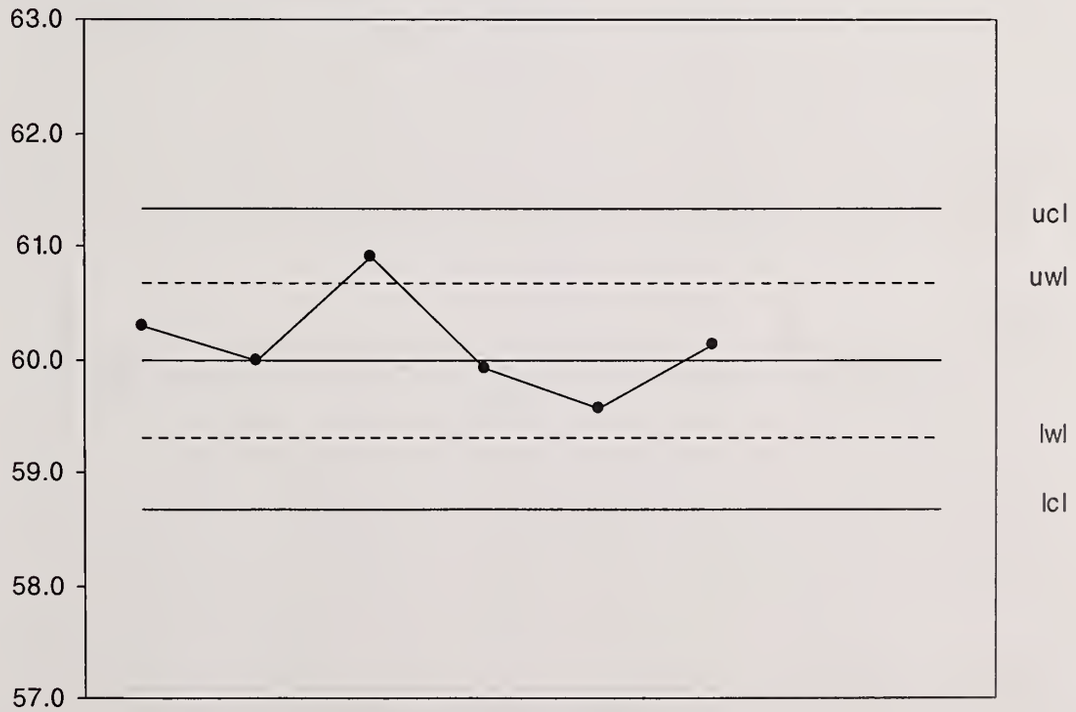
Control Limits: (µg/m3)

Check & Recovery Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
CS1	9.340	8.660	9.510	8.490
CS2	91.680	88.320	92.520	87.480
CS4	12.800	11.140	13.210	10.730
CS5	16.900	15.480	17.250	15.130

Nitrate NO_3^- (E3004)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 28.6 µg/m^3 (100.00 mg/L) as NO_3^-

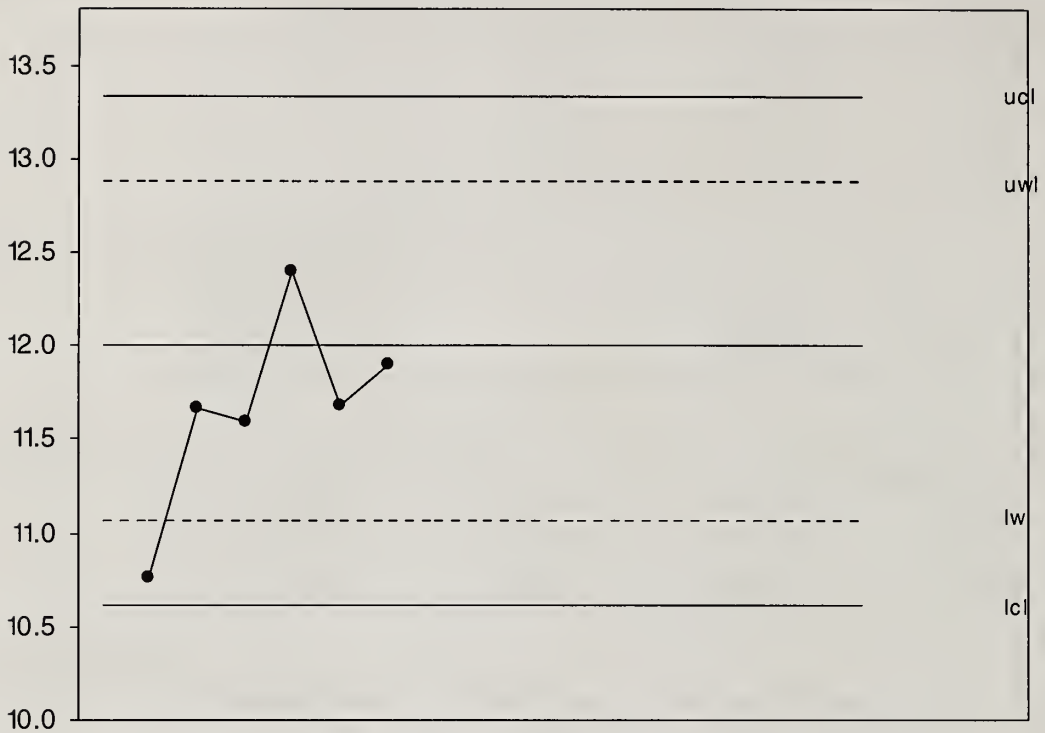


Quality Control QCA + QCB

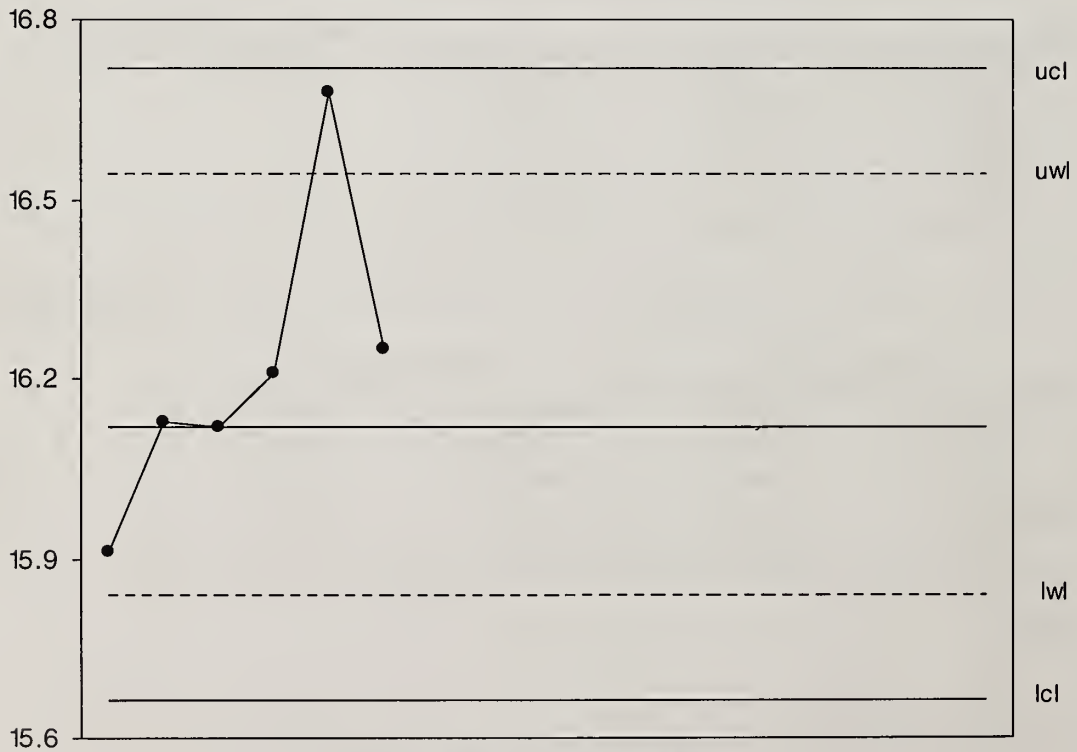


Quality Control QCA - QCB

Nitrate NO_3^- (E3004)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 28.6 µg/m^3 (100.00 mg/L) as NO_3^-

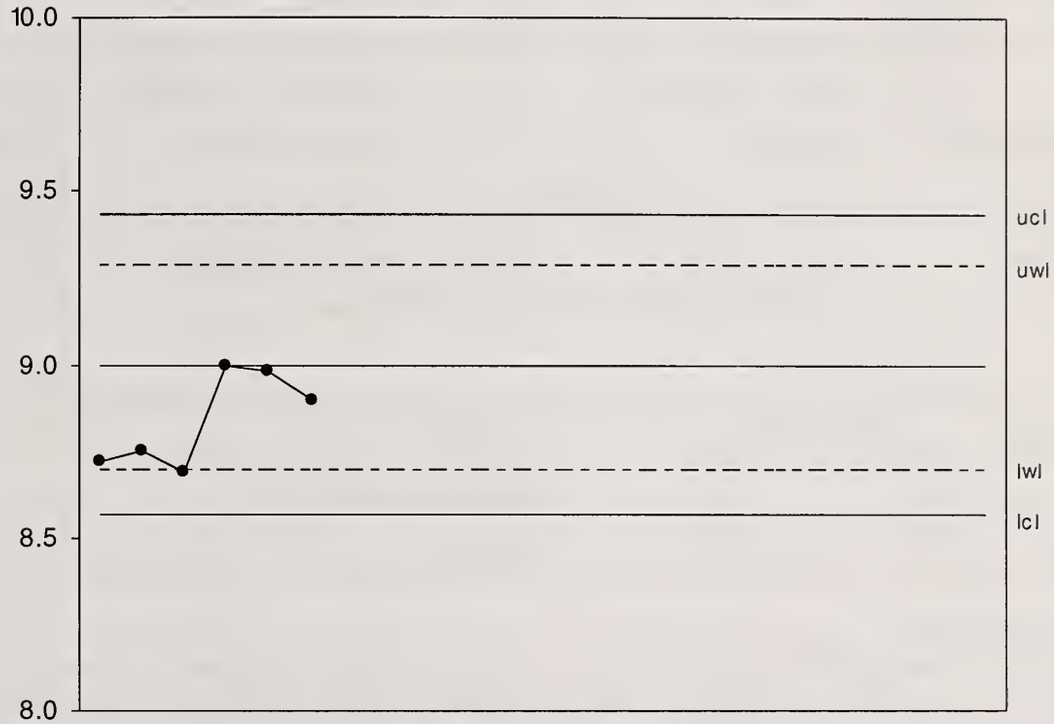


Quality Control CS4

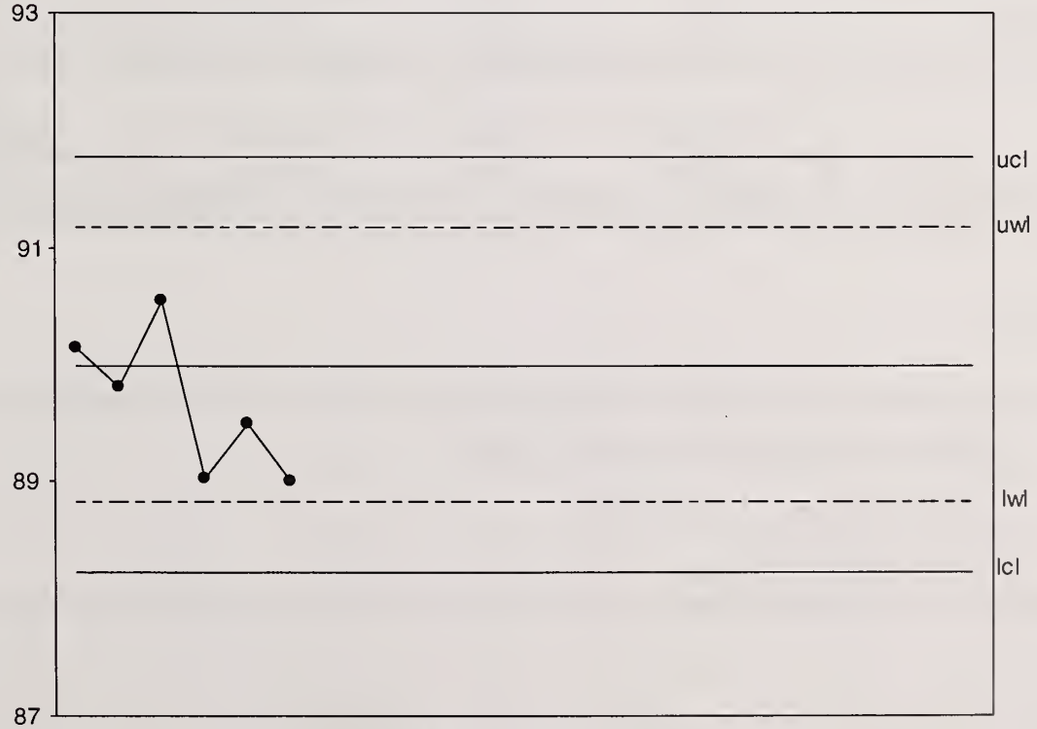


Quality Control CS5

Nitrate NO_3^- (E3004)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 28.6 µg/m^3 (100.00 mg/L) as NO_3^-



Quality Control CS1



Quality Control CS2

NITRILOTRIACETIC ACID

ACCREDITATION & DRINKING-WATER LICENSING STATUS

ACCREDITED ☑	Licensed (Drinking Water) ☑
	Drinking Water Standard (SDWA): 0.4 mg/L

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	04/17/98
Method Reference No.	E3406	Reporting Unit	mg/L as NTA
LIMS Product Code	NTA3406, TCLPNTA3406	Supervisor	P. Wilson
Sample Type/Matrix	Drinking Water for NTA3406; unknown, dried sludge, sediment, soil and industrial waste for TCLPNTA3406		

SAMPLING:

Quantity Required	50 mL
Container	Glass or plastic
Preservative(s)	None

ANALYTICAL PROCEDURE:

Nitrilotriacetic Acid is separated from other anions in the samples by automated suppressed gradient ion chromatography. A sodium hydroxide eluent is used with conductivity detection. The concentration of Nitrilotriacetic acid in mg/L as NTA is determined by comparison of the sample scan to a series of standard scans.

INSTRUMENTATION:

Basic modular continuous flow ion chromatographic system with gradient flow control module.

REPORTING:

Max. Significant Figures: 3	Current W value: 0.01	Current T value: 0.05	Full Scale: 1.00 mg/L

CALIBRATION:

BL plus 7 standards

CONTROLS:

Calibration	LTBL plus 2 standards, e.g. QCA, QCB
Drift	1 standard every 10 samples
Spike	1 blank plus 3 samples

Nitrilotriacetic Acid (E3406)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 1.00 mg/L as NTA

Calibration Control

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	31	0.800	0.799	-0.001	0.007
B	31	0.200	0.199	-0.001	0.009
A + B		1.000	0.999	-0.001	0.012
A - B		0.600	0.600	0.000	0.009

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.005
	Within Runs	0.006
	Between/Within	0.833

Control Limits

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	1.030	0.980	1.050	0.950
A - B	0.630	0.570	0.640	0.560

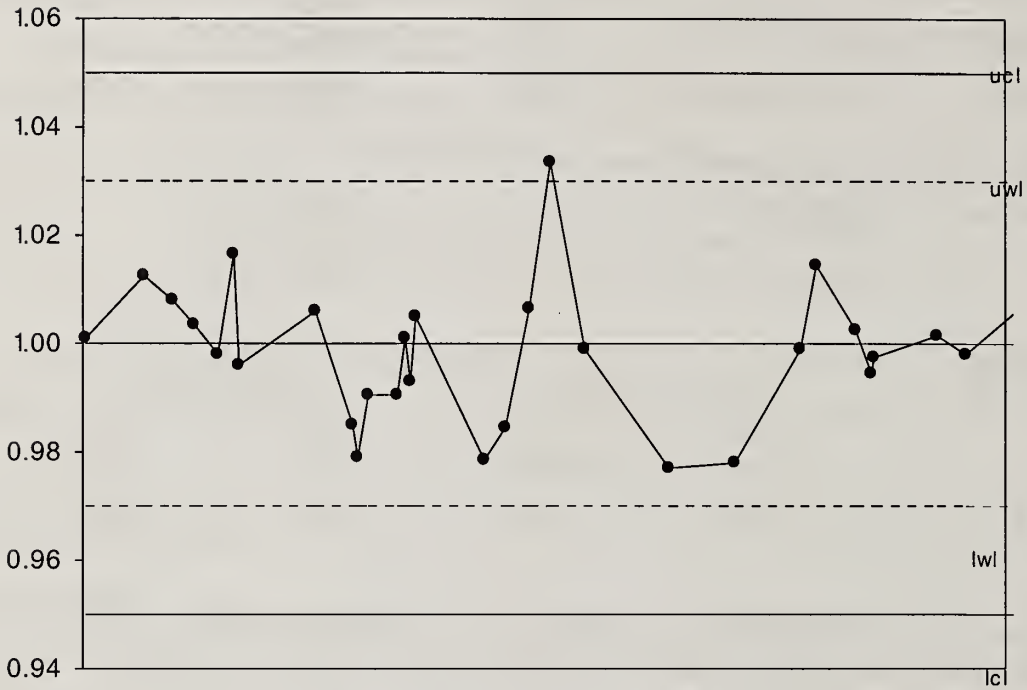
Duplicates

Number	Concentration	Std. Dev.	% Coeff of Var
15	0.00 - 0.10	0.005	5.409
11	0.10 - 0.20	0.005	4.456
6	0.20 - 0.50	0.007	2.252
2	0.50 - 1.00	N/A	N/A
34	Total	0.006	3.152

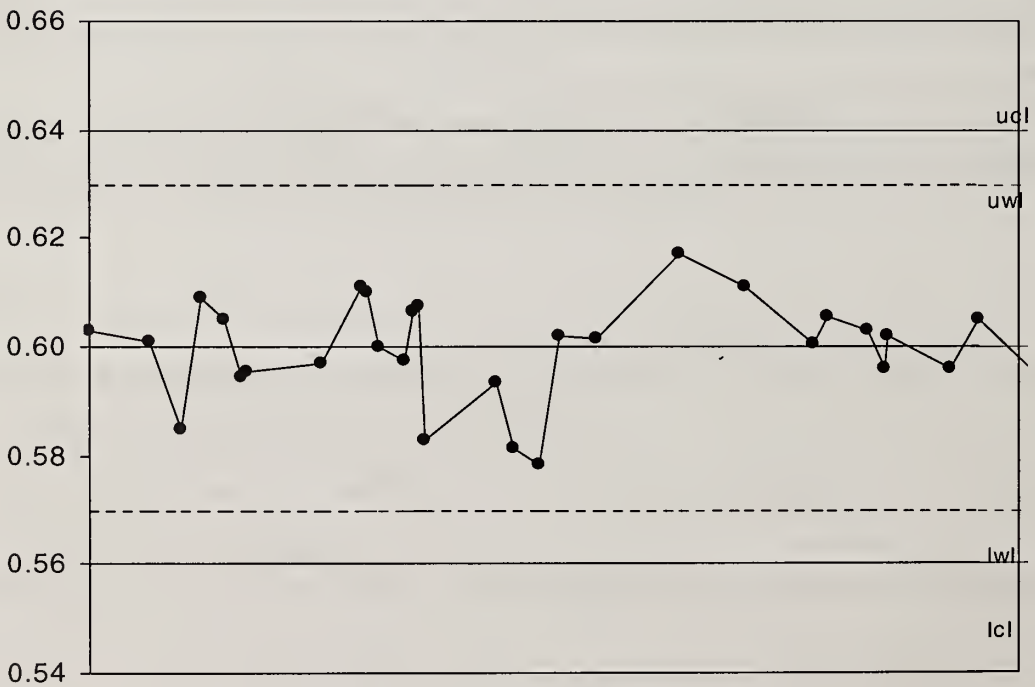
Recoveries

Number	Expected	Mean	Std. Dev.
105	0.100	0.107	0.087

Nitrilotriacetic Acid (E3406)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 1.00 mg/L as NTA



Quality Control Standard A + B



Quality Control Standard A - B

NITROGEN, AMMONIA PLUS AMMONIUM

ACCREDITATION & DRINKING-WATER LICENSING STATUS

ACCREDITED ☑	Licensed (Drinking Water) ☑
	Drinking Water Standard (SDWA): N/A

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/78
Method Reference No.	E3364	Reporting Unit	mg/L as N
LIMS Product Code	DISNUT3364	Supervisor	P.Wilson
Sample Type/Matrix	Drinking Water, Precipitation, Surface Water		

SAMPLING:

Quantity Required	10 mL
Container	Glass or plastic
Preservative (s)	None

ANALYTICAL PROCEDURE:

Ammonia plus ammonium ions are determined on the supernatant of a settled sample via the formation of indophenol blue in a buffered system using nitroprusside as a catalyst. A reference stream, which differs from the colour formation stream by replacement of the catalyst with an equal flow of water, is employed to suppress sample matrix effects.
Approximate absorbance: 0.5 at the full scale level.
Nitrate plus nitrite, nitrite, and reactive orthophosphate are determined simultaneously.

INSTRUMENTATION:

Basic automated modular continuous flow system plus two 38^0C heating baths (7.7 mL delay).
Colourimetric measurement is through a 1.5 cm. light path at 630 nm.
Data capture and processing is via a computer system.

REPORTING:

Max. Significant Figures: 3	Current W value: 0.002	Current T value: 0.010	Full Scale: 2 mg/L

CALIBRATION:

BL plus 7 standards

CONTROLS:

Calibration	LTBL plus 3 standards, e.g. QCA, QCB, QCC
Drift	BL, standard , Drift control(s) and BL after every 20 samples

Nitrogen; Ammonia + Ammonium (E3364)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 2.000 mg/L as N

Calibration Control

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	133	1.6	1.5938	-0.0062	0.0085
B	133	0.8	0.7966	-0.0034	0.0053
C	133	0.16	0.159	-0.001	0.0049
A + B		2.4	2.3904	-0.0096	0.0105
A - B		0.8	0.7971	-0.0029	0.0096
B + C		0.96	0.9556	-0.0044	0.0074
B - C		0.64	0.6377	-0.0023	0.0071

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.0071
	Within Runs	0.0068
	Between/Within	1.0441
s.d.(BC)	Between Runs	0.0051
	Within Runs	0.005
	Between/Within	1.02

Control Limits

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	2.424	2.376	2.447	2.353
A - B	0.824	0.776	0.835	0.765
B + C	0.974	0.946	0.989	0.933
B - C	0.654	0.626	0.662	0.618

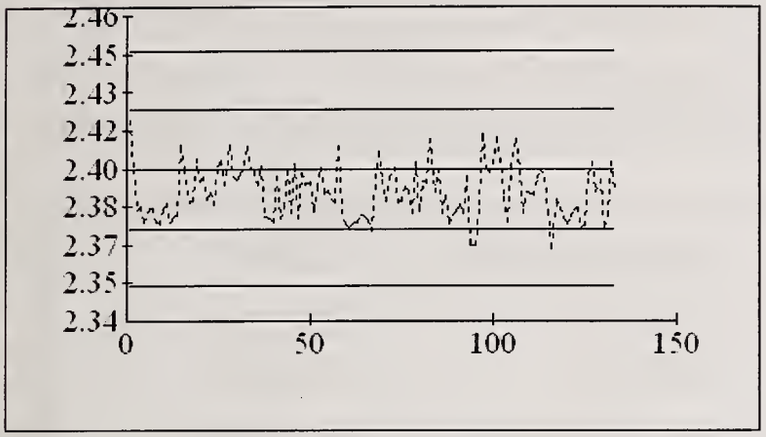
Duplicates

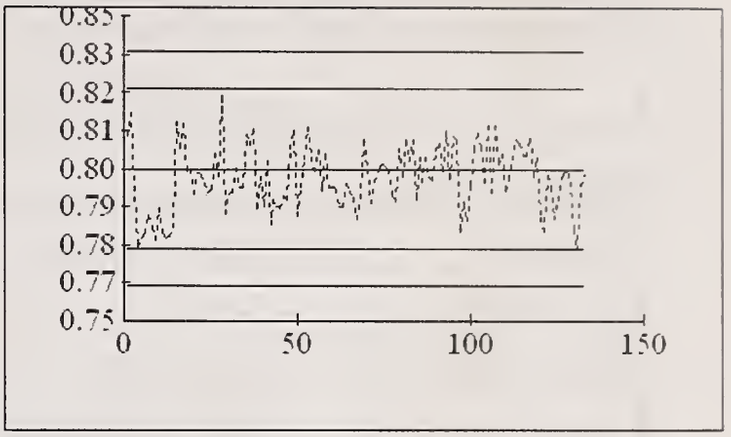
Number	Concentration	Std. Dev.	% Coeff of Var
360	0 - 10%	0.003	13.3
21	10 - 20%	0.005	1.8
9	20 - 50%	0.011	1.9
4	50 - 100%	0.018	1.5
394	Total	0.004	6.6

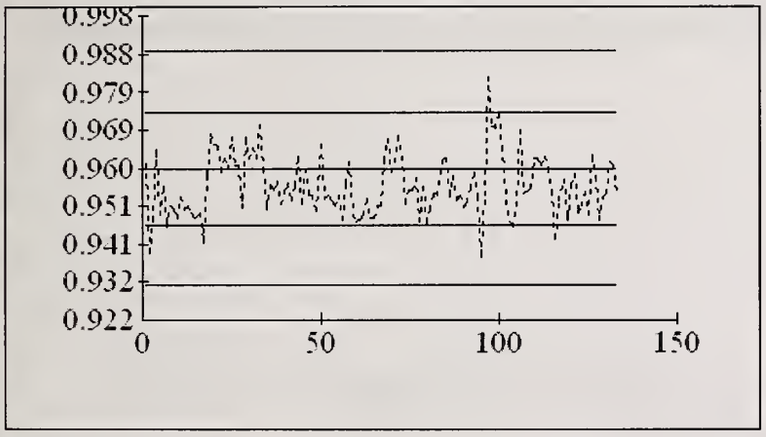
Other Checks	Number	Mean	Std. Dev.
LTB	130	0.0031	0.0058

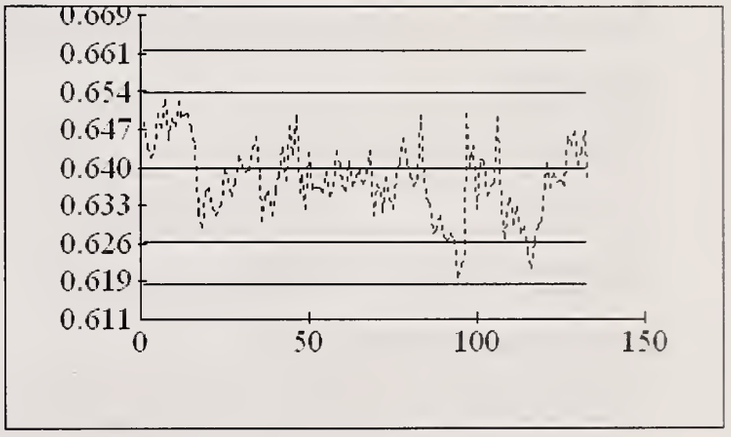
Nitrogen; ammonia+ammonium (E3364)

QC Data: 1/1/2008 to 12/31/2008









NITROGEN, AMMONIA PLUS AMMONIUM

ACCREDITATION & DRINKING-WATER LICENSING STATUS

ACCREDITED	☑	Licensed (Drinking Water)	N/A
		Drinking Water Standard (SDWA): N/A	

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/77
Method Reference No.	E3366	Reporting Unit	mg/L as N
LIMS Product Code	DISNUT3366	Supervisor	P.Wilson
Sample Type/Matrix	Sludge, Effluent, Raw Sewage, Industrial Waste, Process Water, Leachate, Ground Water and Surface Water.		

SAMPLING:

Quantity Required	10 mL
Container	Glass or plastic
Preservative(s)	None

ANALYTICAL PROCEDURE:

Ammonia plus ammonium ions are determined on the supernatant of a settled sample via the formation of indophenol blue in a buffered system using nitroprusside as a catalyst.
Approximate absorbance: 0.7 at the full scale level.
Reactive orthophosphate, nitrogen-nitrite and nitrogen-nitrate plus nitrite are determined simultaneously.

INSTRUMENTATION:

Basic automated modular continuous flow system plus one 38^0C heating bath (7.7 mL delay). Colourimetric measurement is through a 1.5 cm. light path at 630 nm. Data capture and processing is via a computer system.

REPORTING:

Max. Significant Figures: 3	Current W value: 0.05	Current T value: 0.25	Full Scale: 50 mg/L

CALIBRATION:

BL plus 7 standards

NITROGEN, AMMONIA PLUS AMMONIUM cont'd

CONTROLS:

Calibration	LTBL plus 3 standards, e.g. QCA, QCB, QCC
Drift	BL , standard, drift control(s) and BL every 20 samples

Nitrogen; Ammonia + Ammonium (E3366)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 50.00 mg/L as N

Calibration Control

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	74	40	39.961	0.039	0.134
B	74	20	20.029	0.029	0.1
C	74	4	3.999	0.001	0.04
A + B		60	59.99	0.01	0.199
A - B		20	19.933	0.067	0.127
B + C		24	24.027	0.027	0.12
B - C		16	16.03	0.03	0.094

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.118
	Within Runs	0.09
	Between/Within	1.311
s.d.(BC)	Between Runs	0.076
	Within Runs	0.066
	Between/Within	1.152

Control Limits

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	60.620	59.380	61.200	58.760
A - B	20.620	19.380	20.900	19.070
B + C	24.330	23.670	24.700	23.340
B - C	16.330	15.670	16.500	15.500

Duplicates

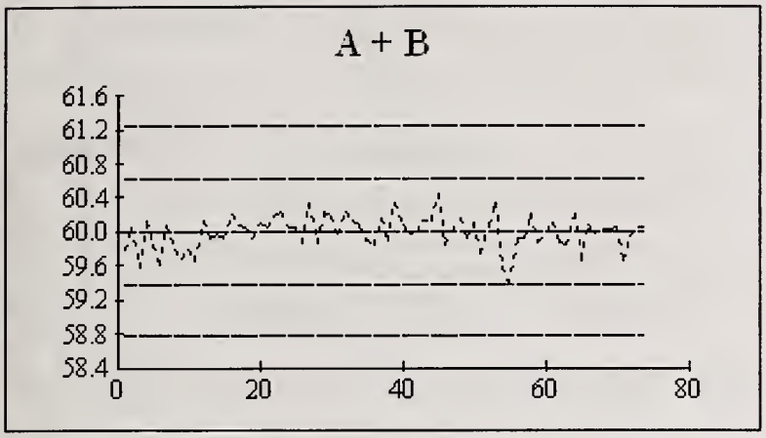
Number	Concentration	Std. Dev.	% Coeff of Var
167	0 - 10%	0.04	16.172
16	10 - 20%	0.043	0.568
10	20 - 50%	0.09	0.581
0	50 - 100%	N/A	N/A
193	Total	0.044	2.677

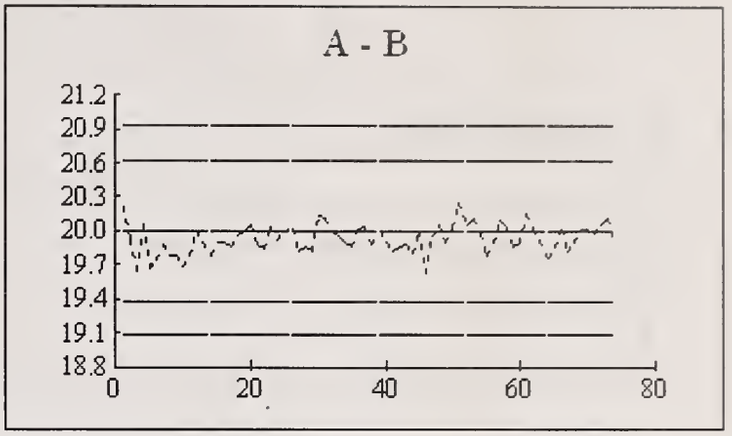
Other Checks

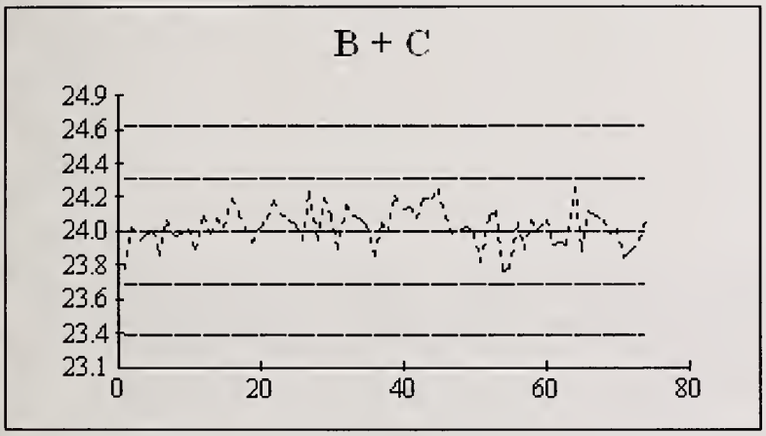
	Number	Mean	Std. Dev.
LTB	74	-0.02	0.023

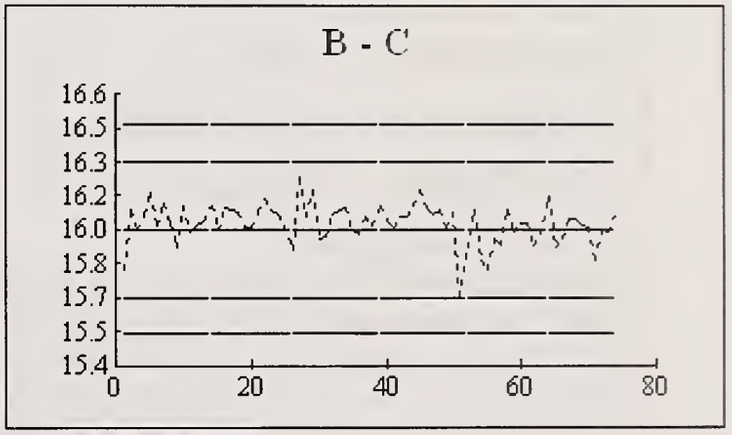
Nitrogen; ammonia+ammonium (E3366)

QC Data; 1/1/2008 to 12/31/2008









NITROGEN, NITRATE PLUS NITRITE

ACCREDITATION & DRINKING-WATER LICENSING STATUS

ACCREDITED ☑	Licensed (Drinking Water) ☑
	Drinking Water Standard (SDWA): 10 mg/L

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/78
Method Reference No.	E3364	Reporting Unit	mg/L as N
LIMS Product Code	DISNUT3364	Supervisor	P.Wilson
Sample Type/Matrix	Drinking Water, Precipitation, Surface Water		

SAMPLING:

Quantity Required	10 mL
Container	Glass or plastic
Preservation (s)	None

ANALYTICAL PROCEDURE:

Nitrate plus nitrite is determined on the supernatant of a settled sample. Nitrate is reduced to nitrite in alkaline media at 37^{0}C, by hydrazine sulphate with copper as a catalyst. Colourimetry is based on the formation of an azo dye by nitrite, sulphanilamide, and N(1-napthyl) ethylenediamine dihydrochloride. To control metal ion interference, samples are passed through an ion-exchange column prior to the reduction step. Approximate absorbance: 0.6 at the full scale level.
Ammonia plus ammonium, nitrite, and reactive orthophosphate are determined simultaneously.

INSTRUMENTATION:

Basic automated modular continuous flow system plus the following modules: 38^{0}C heating bath (7.7 mL delay), ion exchange column. Colourimetric measurement is through a 1.5 cm. light path at 520 nm. Data capture and processing is via a computer system.

REPORTING:

Max. Significant Figures: 3	Current W value: 0.005	Current T value: 0.025	Full Scale: 12.008 mg/L

CALIBRATION:

BL plus 7 standards

CONTROLS:

Calibration	LTBL plus 3 standards, e.g. QCA, QCB, QCC
Drift	BL , standard, drift control(s) and BL every 20 samples
Interference	Nitrate standard spiked with calcium (150 mg/L) and magnesium (50 mg/L) confirms effective interference suppression.
Recovery	Individual nitrate and nitrite standards of equal N concentration show effectiveness of reduction step.

NOTES:

Concentration Range was extended from 5 mg/L to 12.008 mg/L in October 2006.

Nitrogen; Nitrate + Nitrite (E3364)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 12.008 mg/L as N

Calibration Control

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	133	9.61	9.5823	-0.0277	0.0539
B	133	4.8	4.7951	-0.0049	0.0359
C	133	0.961	0.9554	-0.0056	0.0138
A + B		14.41	14.3774	-0.0326	0.07
A - B		4.81	4.7872	-0.0228	0.0591
B + C		5.761	5.7505	-0.0105	0.0419
B - C		3.839	3.8397	0.0007	0.0347

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.0458
	Within Runs	0.0418
	Between/Within	1.0957
s.d.(BC)	Between Runs	0.0272
	Within Runs	0.0245
	Between/Within	1.1102

Control Limits

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	14.556	14.264	14.702	14.118
A - B	4.956	4.664	5.029	4.591
B + C	5.851	5.671	5.941	5.581
B - C	3.929	3.749	3.974	3.704

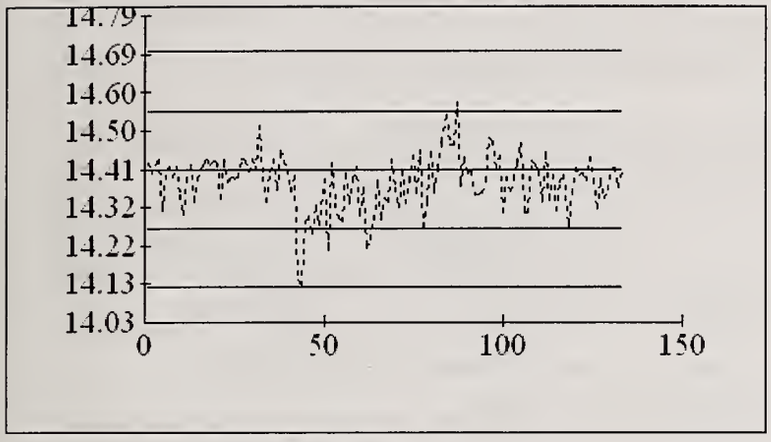
Duplicates

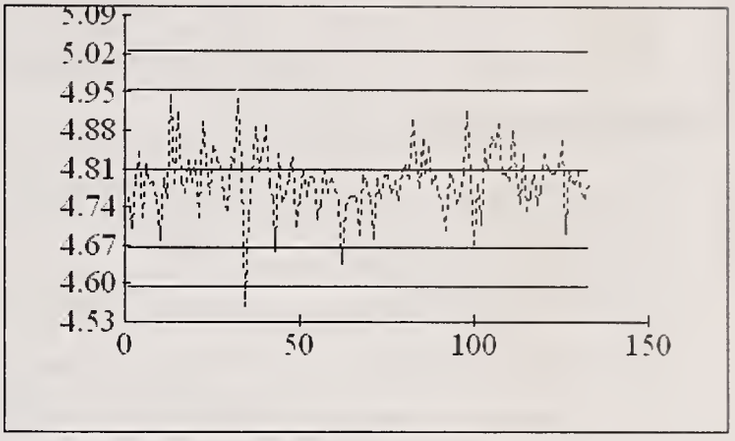
Number	Concentration	Std. Dev.	% Coeff of Var
248	0 - 10%	0.013	6.6
52	10 - 20%	0.025	3.6
44	20 - 50%	0.035	2.1
31	50 - 100%	0.037	1.1
392	Total	0.027	2.8

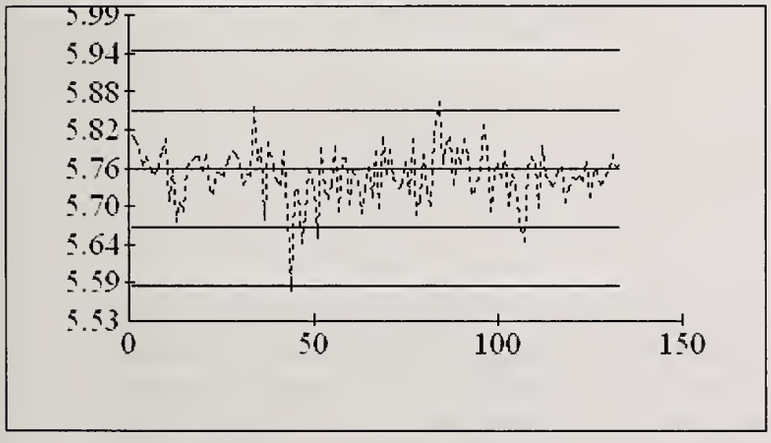
Other Checks	Number	Mean	Std. Dev.
LTB	130	-0.0068	0.0104

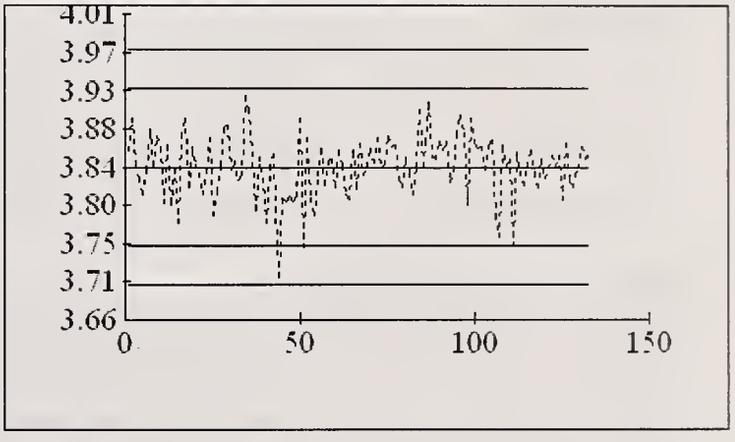
Nitrogen; nitrate+nitrite (E3364)

QC Data: 1/1/2008 to 12/31/2008









NITROGEN, NITRATE PLUS NITRITE

ACCREDITATION & DRINKING-WATER LICENSING STATUS

ACCREDITED ☑	Licensed (Drinking Water) N/A
	Drinking Water Standard (SDWA): N/A

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/78
Method Reference No.	E3366	Reporting Unit	mg/L as N
LIMS Product Code	DISNUT3366,TCLPNOT3366	Supervisor	P.Wilson
Sample Type/Matrix	Sludge, Effluent, Raw Sewage, Industrial Waste, Process Water, Leachate, Ground Water and Surface Water		

SAMPLING:

Quantity Required	10 mL
Container	Glass or plastic
Preservative (s)	None

ANALYTICAL PROCEDURE:

Nitrate plus nitrite is determined on the supernatant of a settled sample. Nitrate is reduced to nitrite in alkaline media at 38^{0}C, by hydrazine sulphate with copper as a catalyst. Colourimetry is based on the formation of an azo dye by nitrite, sulphanilamide, and N(1-napthyl) ethylenediamine dihydrochloride. To control metal ion interference, samples are passed through an ion-exchange column prior to the reduction step. Approximate absorbance: 0.7 at the full scale level.
Ammonia plus ammonium, nitrite, and reactive phosphate are determined simultaneously.

INSTRUMENTATION:

Basic automated modular continuous flow system plus the following modules: 38^{0}C heating bath (7.7 mL delay). Colourimetric measurement is through a 1.5 cm. light path at 520 nm. Data capture and processing is via a computer system.

REPORTING:

Max. Significant Figures: 3	Current W value: 0.05	Current T value: 0.25	Full Scale: 50.0 mg/L

CALIBRATION:

BL plus 7 standards

CONTROLS:

Calibration	LTBL plus 3 standards, e.g. QCA, QCB, QCC
Drift	BL ,standard, drift control(s) and BL every 20 samples
Interference	Nitrate standard spiked with calcium (150 mg/L) and magnesium (50mg/L) confirms effective interference suppression.
Recovery	Individual nitrate and nitrite standards of equal N concentration show effectiveness of reduction step.

Nitrogen; Nitrate + Nitrite (E3366)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 50.00 mg/L as N

Calibration Control

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	74	40	39.99	0.01	0.144
B	74	20	20.082	0.082	0.099
C	74	4	4.021	0.021	0.039
A + B		60	60.072	0.072	0.197
A - B		20	19.908	0.092	0.149
B + C		24	24.103	0.103	0.117
B - C		16	16.061	0.061	0.095

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.124
	Within Runs	0.105
	Between/Within	1.181
s.d.(BC)	Between Runs	0.075
	Within Runs	0.067
	Between/Within	1.119

Control Limits

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	60.670	59.330	61.300	58.366
A - B	20.670	19.330	21.000	18.990
B + C	24.360	23.640	24.700	23.260
B - C	16.360	15.640	16.500	15.460

Duplicates

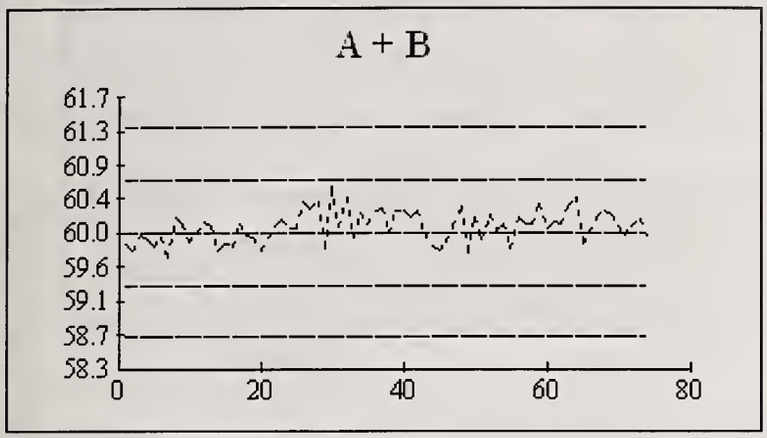
Number	Concentration	Std. Dev.	% Coeff of Var
149	0 - 10%	0.108	10.33
23	10 - 20%	0.036	0.53
40	20 - 50%	0.093	0.588
6	50 - 100%	0.177	0.633
218	Total	0.103	2.018

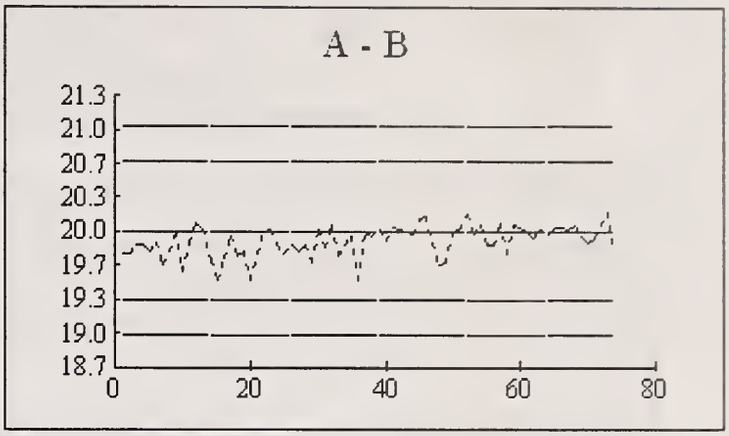
Other Checks

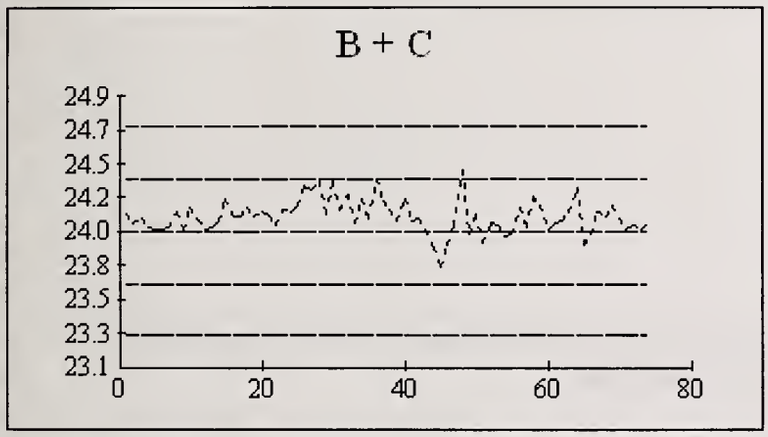
	Number	Mean	Std. Dev.
LTB	74	-0.033	0.033

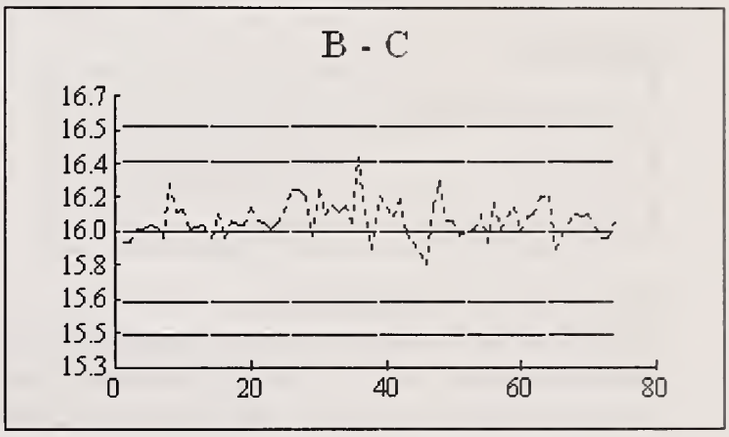
Nitrogen; nitrate+nitrite (E3366)

QC Data; 1/1/2008 to 12/31/2008









NITROGEN, NITRITE

ACCREDITATION & DRINKING-WATER LICENSING STATUS

ACCREDITED ☑	Licensed (Drinking Water) ☑
	Drinking Water Standard (SDWA): 1.0 mg/L

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/78
Method Reference No.	E3364	Reporting Unit	mg/L as N
LIMS Product Code	DISNUT3364	Supervisor	P.Wilson
Sample Type/Matrix	Drinking Water, Precipitation, Surface Water		

SAMPLING:

Quantity Required	10 mL
Container	Glass or plastic
Preservative(s)	None

ANALYTICAL PROCEDURE:

Nitrite is determined on the supernatant of a settled sample by formation of an azo dye using sulphanilamide, and N(1-napthyl) ethylenediamine dihydrochloride.
Approximate absorbance: 0.6 at the full scale level.
Ammonia plus ammonium, nitrate plus nitrite, and reactive orthophosphate are determined simultaneously.

INSTRUMENTATION:

Basic automated modular continuous flow system with colourimetric measurement through a 5.0 cm. light path at 520 nm.
Data capture and processing is via a computer system.

REPORTING:

Max. Significant Figures: 3	Current W value: 0.001	Current T value: 0.005	Full Scale: 0.200 mg/L

CALIBRATION:

BL plus 7 standards

CONTROLS:

Calibration	LTBL plus 3 standards, e.g. QCA, QCB, QCC
Drift	BL , standard, drift control(s) and BL after every 20 samples
Interference	Nitrate standard spiked with calcium (150 mg/L) and magnesium (50 mg/L) confirms effective interference suppression.
Recovery	Individual nitrate and nitrite standards of equal N concentration show effectiveness of reduction step.

Nitrogen; Nitrite (E3364)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 0.200 mg/L as N

Calibration Control

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	132	0.16	0.1599	-0.0001	0.0014
B	132	0.08	0.0803	0.0003	0.0006
C	132	0.016	0.0159	-0.0001	0.0007
A + B		0.24	0.2402	0.0002	0.0017
A - B		0.08	0.0797	-0.0003	0.0015
B + C		0.096	0.0961	0.0001	0.0011
B - C		0.064	0.0644	0.0004	0.0008

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.0011
	Within Runs	0.0011
	Between/Within	1
s.d.(BC)	Between Runs	0.0007
	Within Runs	0.0006
	Between/Within	1.1667

Control Limits

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	0.243	0.237	0.247	0.235
A - B	0.083	0.077	0.084	0.076
B + C	0.098	0.094	0.100	0.092
B - C	0.066	0.062	0.067	0.061

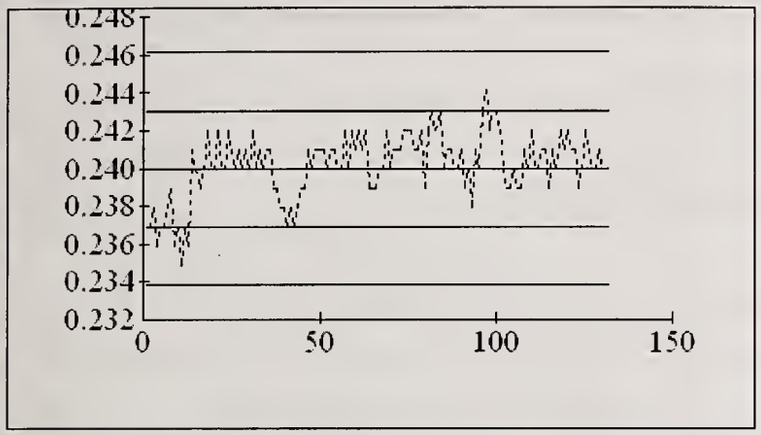
Duplicates

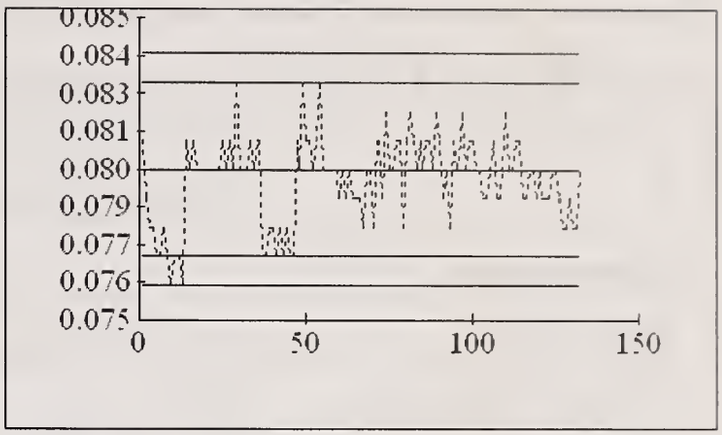
Number	Concentration	Std. Dev.	% Coeff of Var
265	0 - 10%	0.001	22.3
32	10 - 20%	0.001	3.3
21	20 - 50%	0.003	4.8
4	50 - 100%	0.002	1.3
322	Total	0.001	7.9

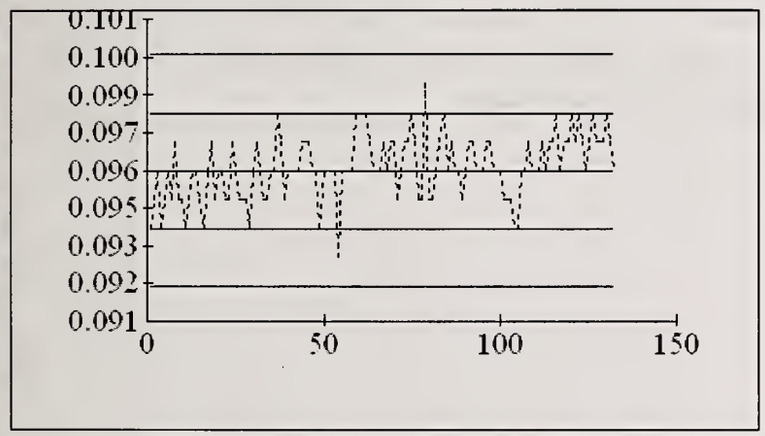
Other Checks	Number	Mean	Std. Dev.
LTB	127	0.0006	0.0008

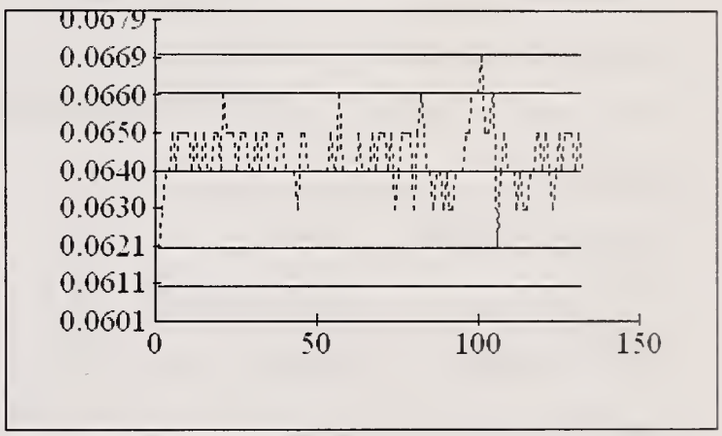
Nitrogen; nitrite (E3364)

QC Data: 1/1/2008 to 12/31/2008









NITROGEN, NITRITE

ACCREDITATION & DRINKING-WATER LICENSING STATUS

ACCREDITED ☑	Licensed (Drinking Water) N/A
	Drinking Water Standard (SDWA): N/A

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/78
Method Reference No	E3366	Reporting Unit	mg/L as N
LIMS Product Code	DISNUT3366	Supervisor	P.Wilson
Sample Type/Matrix	Sludge, Effluent, Raw Sewage, Industrial Waste, Process Water, Leachate, Ground Water and Surface Water.		

SAMPLING:

Quantity Required	10 mL
Container	Glass or plastic
Preservative(s)	None

ANALYTICAL PROCEDURE:

Nitrite is determined on the supernatant of a settled sample by formation of an azo dye using sulphanilamide, and N(1-napthyl) ethylenediamine dihydrochloride.
Approximate absorbance: 0.3 at the full scale level.
Ammonia plus ammonium, nitrate plus nitrite, and reactive orthophosphate are determined simultaneously.

INSTRUMENTATION:

Basic automated modular continuous flow system with colourimetric measurement through a 5.0 cm. light path at 520 nm. Data capture and processing is via a computer system.

REPORTING:

Max. Significant Figures: 3	Current W value: 0.005	Current T value: 0.025	Full Scale: 2.00mg/L

CALIBRATION:

BL plus 7 standards

CONTROLS:

Calibration	LTBL plus 3 standards, e.g. QCA, QCB, QCC
Drift	BL ,standard, drift control(s) and BL every 20 samples
Interference	Nitrate standard spiked with calcium (150 mg/L) and magnesium (50 mg/L) confirms effective interference suppression.
Recovery	Individual nitrate and nitrite standards of equal N concentration show effectiveness of reduction step.

Nitrogen; Nitrite (E3366)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 2.000 mg/L as N

Calibration Control

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	74	1.6	1.598	0.002	0.008
B	74	0.8	0.802	0.002	0.006
C	74	0.16	0.16	0	0
A + B		2.4	2.4	0	0.009
A - B		0.8	0.797	0.003	0.01
B + C		0.96	0.962	0.002	0.006
B - C		0.64	0.642	0.002	0.006

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.0067
	Within Runs	0.0071
	Between/Within	0.9437
s.d.(BC)	Between Runs	0.0039
	Within Runs	0.0042
	Between/Within	0.9286

Control Limits

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	2.424	2.376	2.448	2.353
A - B	0.824	0.776	0.836	0.764
B + C	0.972	0.948	0.984	0.936
B - C	0.652	0.628	0.658	0.622

Duplicates

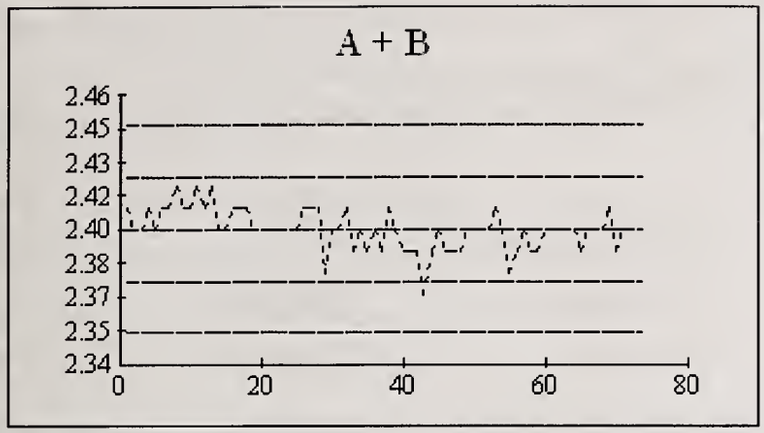
Number	Concentration	Std. Dev.	% Coeff of Var
106	0 - 10%	0.003	6.181
10	10 - 20%	0.007	2.247
9	20 - 50%	0.005	0.712
1	50 - 100%	NA	NA
126	Total	0.003	2.386

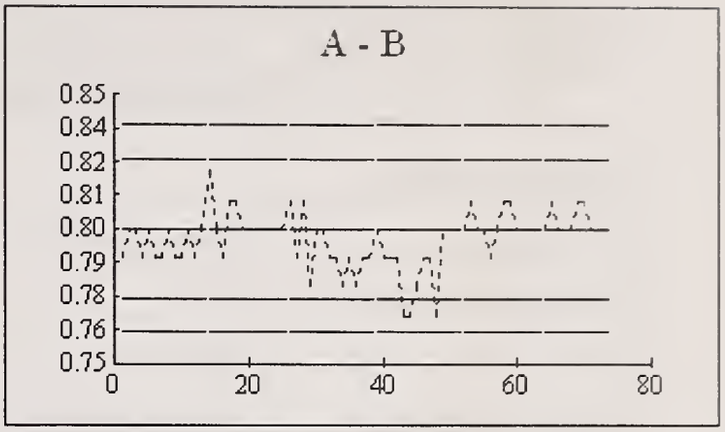
Other Checks

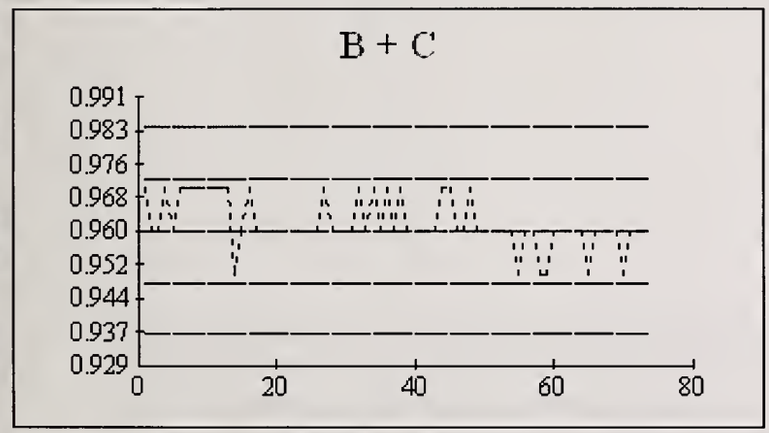
	Number	Mean	Std. Dev.
LTB	74	0.001	0.002

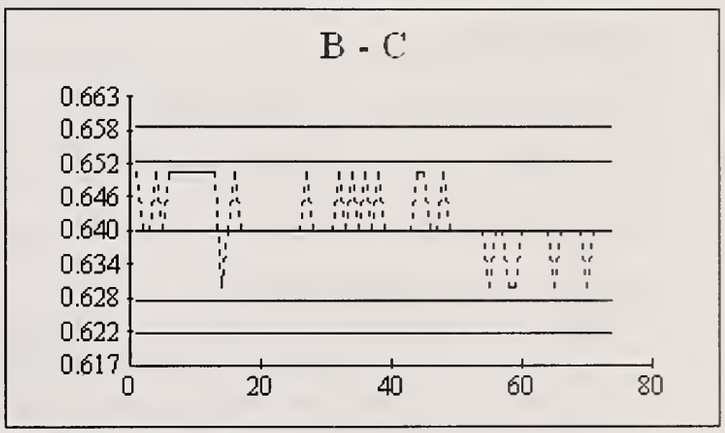
Nitrogen; nitrite (E3366)

QC Data; 1/1/2008 to 12/31/2008









NITROGEN, TOTAL KJELDAHL

ACCREDITATION & DRINKING-WATER LICENSING STATUS

ACCREDITED ☑	Licensed (Drinking Water) N/A
	Drinking Water Standard (SDWA): N/A

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	Mar '89
Method Reference No.	E3116	Reporting Unit	mg/g as N
LIMS Product Code	TNP3116	Supervisor	P. Wilson
Sample Type/Matrix	Soil, Sediment, Dried Sludge and Vegetation		

SAMPLING:

Quantity Required	0.08 to 0.4 g
Container	Glass or plastic
Preservative(s)	N/A

ANALYTICAL PROCEDURE:

Nitrogen compounds are converted to ammonia/ammonium by dissolution of the samples in hot sulphuric acid and potassium persulphate. Potassium persulphate is added later in the digestion to raise the boiling point and to provide a highly oxidizing environment to decompose the more resistant organic matter. The digestate is filtered and the filtrate is analyzed using an automated colourimetric system.

Total phosphorus is determined simultaneously.

INSTRUMENTATION:

Hot plate.

Basic automated modular continuous flow system: 37.5^{0}C bath. Colourimetric measurement is through a 5 cm. light path at 630 nm.

Data capture and processing is via a computer system.

REPORTING:

Max. Significant Figures: 3	Current W value: 0.1	Current T value: 0.5	Full Scale: 10 mg/L

CALIBRATION:

3 High and 2 Low Calibration Standards

CONTROLS:

Drift	Run 80% calibration standard every 10 samples, Drift Control(s)
Recovery	3 digested BL's plus 4 digested standards R1, R2, R3 and R4

NITROGEN, TOTAL KJELDAHL cont'd

NOTES:

System is calibrated with undigested standards. QCA, QCB and QCC were implemented in April 2003. February 2004, Method E3118 was amalgamated with E3116.

Nitrogen; Total Kjeldahl (E3116)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 10.00 mg/L as N

Calibration Control

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	18	8	8.017	0.017	0.029
B	18	4	3.997	-0.003	0.017
C	18	1	0.993	-0.007	0.014
A + B		12	12.013	0.013	0.021
A - B		4	4.02	0.02	0.043
B + C		5	4.989	-0.011	0.028
B - C		3	3.004	0.004	0.015

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.024
	Within Runs	0.03
	Between/Within	0.8
s.d.(BC)	Between Runs	0.016
	Within Runs	0.011
	Between/Within	1.455

Control Limits

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	12.110	11.890	12.220	11.780
A - B	4.110	3.890	4.160	3.840
B + C	5.080	4.920	5.160	4.840
B - C	3.080	2.920	3.120	2.880

Duplicates

Number	Concentration	Std. Dev.	% Coeff of Var
13	0 - 10%	0.044	12.8
21	10 - 20%	0.095	6.8
6	20 - 50%	0.073	2.9
2	50 - 100%	NA	NA
53	Total	0.434	6.9

Recoveries

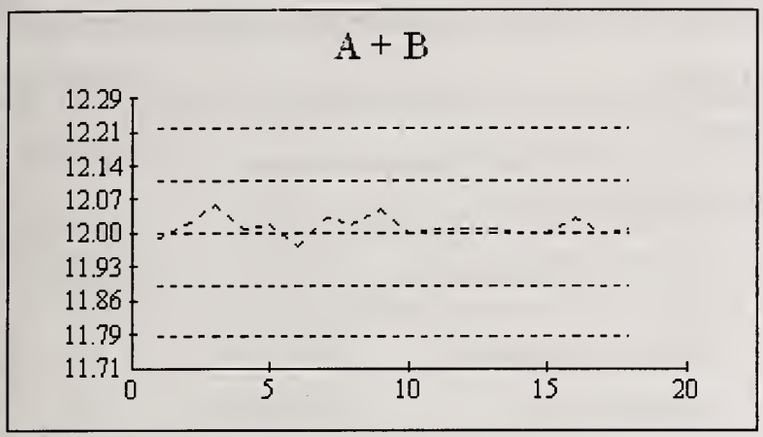
	Number	*Expected*	*Mean*	*Mean Bias*	*Std.Dev.*	*Control Lin*
R1	18	5.250	5.130	-0.120	0.217	4.51-5.9
R2	18	1.690	1.224	-0.466	0.178	1.39-1.9
R3	18	42.200	38.897	-3.303	3.152	35.64-48.

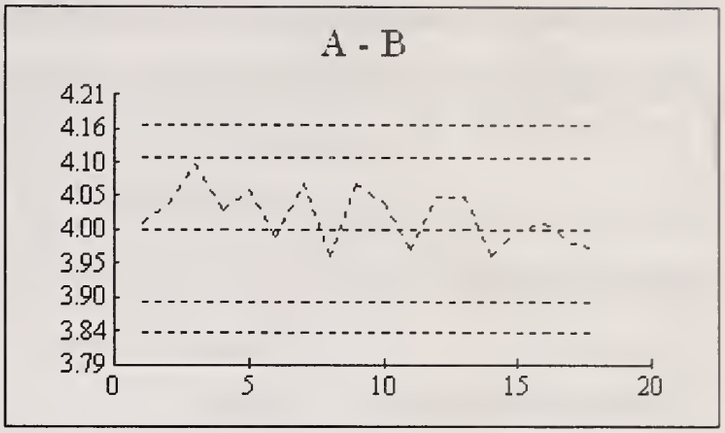
Other Checks

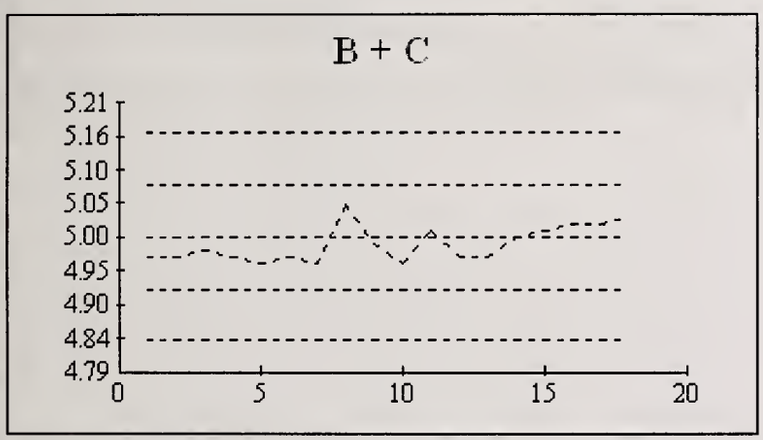
	Number	Mean	Std. Dev.
LTB	18	0.021	0.03
Digested Blank	18	0.07	0.026

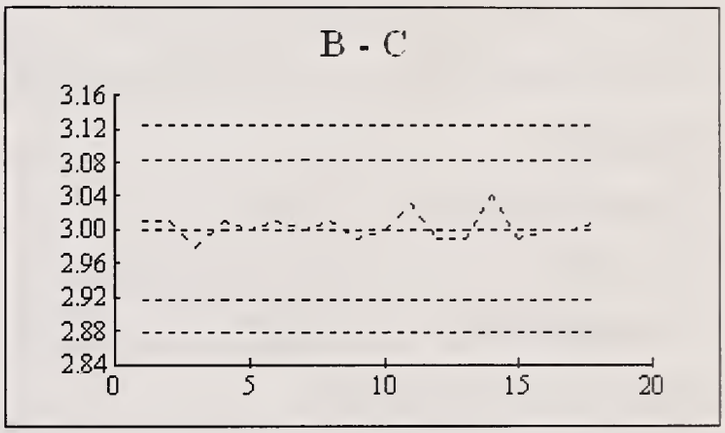
Nitrogen; total Kjeldahl (E3116)

QC Data; 1/1/2008 to 12/31/2008









NITROGEN, TOTAL KJELDAHL

ACCREDITATION & DRINKING-WATER LICENSING STATUS

ACCREDITED ☑	Licensed (Drinking Water) ☑
	Drinking Water Standard (SDWA): N/A

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/79
Method Reference No.	E3367	Reporting Unit	mg/L as N
LIMS Product Code	TOTNUT3367	Supervisor	P.Wilson
Sample Type/Matrix	Precipitation, Drinking Water, Surface Water		

SAMPLING:

Quantity Required	50 mL
Container	Glass or plastic
Preservative(s)	None

ANALYTICAL PROCEDURE:

Samples are digested in a sulphuric acid-mercuric oxide-potassium sulphate media using three block digestors kept at 180^0C, 210^0C and 360^0C. The pH of the digestate is adjusted in-line in two stages and then ammonia is determined by formation of indophenol blue in a buffered system using nitroprusside as a catalyst.

Approximate absorbance: 0.3 at the full scale level.

Total phosphorus is determined simultaneously.

INSTRUMENTATION:

Three block digesters

Basic automated modular continuous flow system plus 1 module: 38^0C bath (7.7 mL delay). Colourimetric measurement is through a 5.0 cm. light path at 630 nm.

Data capture and processing is via a computer system

REPORTING:

Max. Significant Figures: 3	Current W value: 0.02	Current T value: 0.10	Full Scale: 2.0mg/L

CALIBRATION:

BL plus 7 undigested standards

NITROGEN, TOTAL KJELDAHL cont'd

CONTROLS:

Calibration	LTBL plus 3 undigested standards, e.g. QCA, QCB, QCC
Drift	BL, undigested standard , Drift Control(s), BL every 20 samples
Recovery	3 digested BL plus 3 digested standards in duplicate, e.g. R1

Nitrogen; Total Kjeldahl (E3367)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 2.00 mg/L as N

Calibration Control

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	98	1.600	1.590	0.010	0.010
B	98	0.800	0.795	0.005	0.007
C	98	0.160	0.156	0.004	0.007
A + B		2.400	2.384	0.016	0.015
A - B		0.800	0.795	0.005	0.009
B + C		0.960	0.951	0.009	0.011
B - C		0.640	0.638	0.002	0.008

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.009
	Within Runs	0.006
	Between/Within	1.500
s.d.(BC)	Between Runs	0.007
	Within Runs	0.006
	Between/Within	1.167

Control Limits

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	2.440	2.376	2.480	2.320
A - B	0.840	0.760	0.860	0.740
B + C	0.984	0.936	1.007	0.913
B - C	0.663	0.617	0.675	0.605

Duplicates

Number	Concentration	Std. Dev.	% Coeff of Var
84	0 - 10%	0.015	10.952
132	10 - 20%	0.022	7.579
60	20 - 50%	0.037	6.753
5	50 - 100%	0.029	2.665
281	Total	0.025	7.971

Recoveries

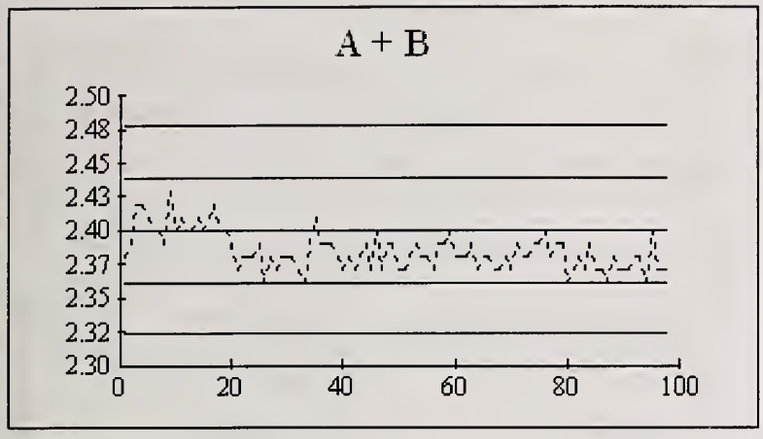
	Number	*Expected*	*Mean*	*Mean Bias*	*Std.Dev.*	*Control Limits*
R1	98	1.40	1.402	0.002	0.066	1.40 ± 0.12
R2	98	0.840	0.845	0.005	0.033	0.84 ± 0.092
R3	97	0.280	0.284	0.004	0.016	0.28 ± 0.064

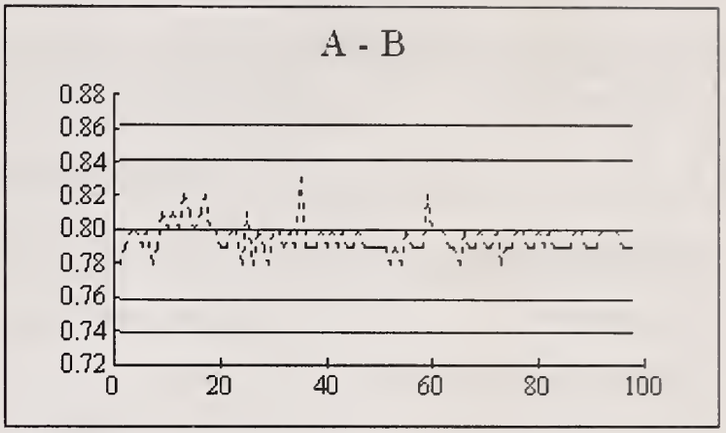
Other Checks

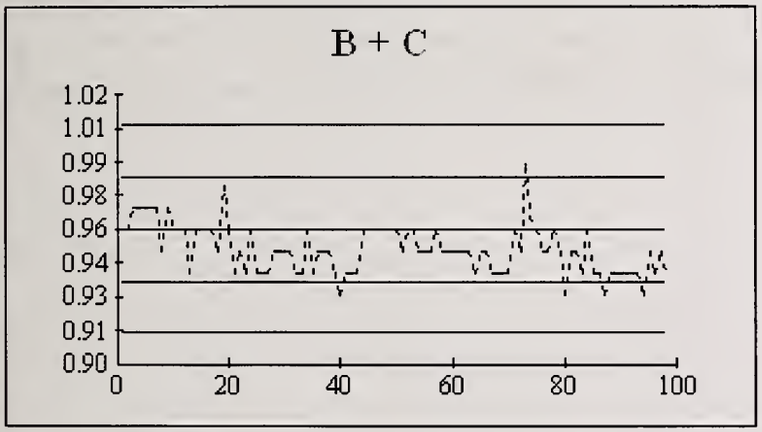
	Number	Mean	Std. Dev.
LTB	98	-0.001	0.007
Digested Blank	98	0.029	0.017

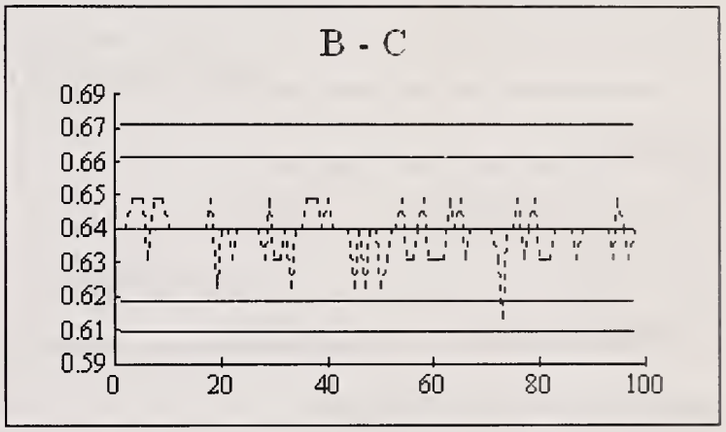
`Nitrogen;total Kjeldahl (E3367)

QC Data; 1/1/2008 to 12/31/2008









NITROGEN, TOTAL KJELDAHL

ACCREDITATION & DRINKING-WATER LICENSING STATUS

ACCREDITED ☑	Licensed (Drinking Water) N/A
	Drinking Water Standard (SDWA): N/A

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/79
Method Reference No	E3368	Reporting Unit	mg/L as N
LIMS Product Code	TOTNUT3368	Supervisor	P. Wilson
Sample Type/Matrix	Sludge, Raw Sewage, Industrial Waste, Effluent, Ground Water, Process Water, Leachate, Precipitation and Surface Water.		

SAMPLING:

Quantity Required	50 mL
Container	Glass or plastic
Preservative(s)	None

ANALYTICAL PROCEDURE:

Samples are digested in a sulphuric acid-mercuric oxide-potassium sulphate media using three block digestors kept at 180^{0}C, 210^{0}C and 360^{0}C. The pH of the digestate is adjusted in-line in two stages and then ammonia is determined by formation of indophenol blue in a buffered system using nitroprusside as a catalyst.
Approximate absorbance: 1.0 at the full scale level.
Total phosphorus is determined simultaneously.

INSTRUMENTATION:

Three block digesters
Basic automated modular continuous flow system plus 1 module: 38^{0}C bath (7.7 mL delay).
Colourimetric measurement is through a 1.5 cm. light path at 630 nm.
Data capture and processing is via a computer system

REPORTING:

Max. Significant Figures: 3	Current W value: 0.05	Current T value: 0.25	Full Scale: 50.0 mg/L

CALIBRATION:

BL plus 7 undigested standards

NITROGEN, TOTAL KJELDAHL cont'd

CONTROLS:

Calibration	LTBL plus 3 undigested standards, e.g. QCA, QCB, QCC
Drift	BL, undigested standard, BL every 20 samples
Recovery	3 digested BL plus 3 digested standards in duplicate, e.g. R1

NOTES:

System is calibrated with undigested standards.

Nitrogen; Total Kjeldahl (E3368)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 50.00 mg/L as N

Calibration Control

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	43	40.000	40.070	0.070	0.223
B	43	20.000	20.025	0.025	0.105
C	43	4.000	4.013	0.013	0.035
A + B		60.000	60.095	0.095	0.275
A - B		20.000	20.046	0.046	0.214
B + C		24.000	24.037	0.037	0.112
B - C		16.000	16.012	0.012	0.108

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.174
	Within Runs	0.151
	Between/Within	1.152
s.d.(BC)	Between Runs	0.078
	Within Runs	0.076
	Between/Within	1.026

Control Limits

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	60.360	59.640	60.730	59.270
A - B	20.360	19.640	20.550	19.450
B + C	24.210	23.790	24.420	23.580
B - C	16.210	15.790	16.320	15.680

Duplicates

Number	Concentration	Std. Dev.	% Coeff of Var
114	0 - 10%	0.057	9.758
9	10 - 20%	0.114	1.437
2	20 - 50%	0.431	2.301
1	50 - 100%	NA	NA
126	Total	0.085	5.272

Recoveries

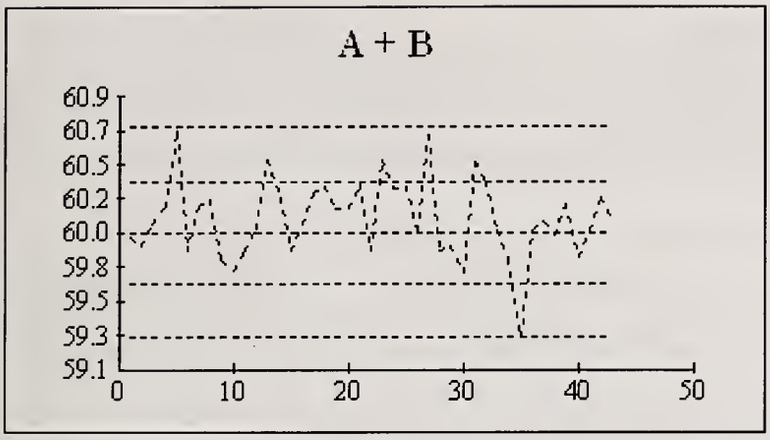
	Number	*Expected*	*Mean*	*Mean Bias*	*Std.Dev.*	*Control Limits*
R1	43	35	35.014	0.014	0.700	± 2
R2	43	21	21.101	0.101	0.350	± 1.32
R3	43	7	6.882	-0.118	0.517	± 0.62

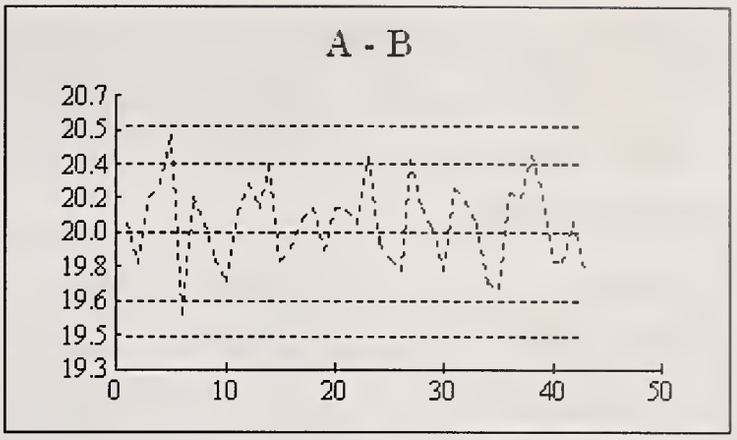
Other Checks

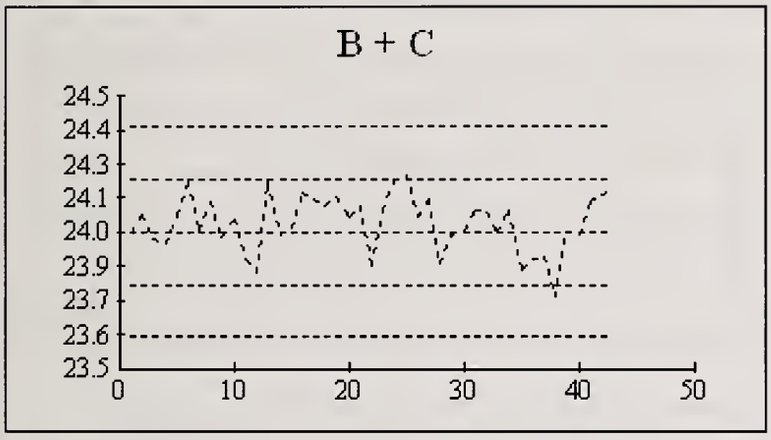
	Number	Mean	Std. Dev.
LTB	43	-0.012	0.039
Digested Blank	43	0.004	0.046

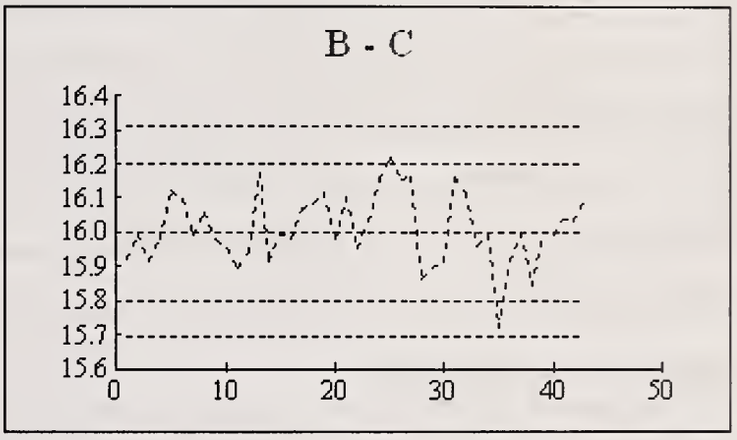
Nitrogen; total Kjeldahl (E3368)

QC Data; 1/1/2008 to 12/31/2008









OXYGEN DEMAND, BIOCHEMICAL

ACCREDITATION & DRINKING-WATER LICENSING STATUS

ACCREDITED ☑	Licensed (Drinking Water) N/A
	Drinking Water Standard (SDWA): N/A

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	Before '61
Method Reference No.	E3182	Reporting Unit	mg/L as O_2
LIMS Product Code	BOD3182, BODC3182	Supervisor	P. Wilson
Sample Type/Matrix	Raw Sewage, Industrial Waste, Effluent, Ground Water, Leachate, Surface Water		

SAMPLING:

Quantity Required:	400 mL
Container:	Glass or plastic
Preservative(s)	None

SAMPLE PREPARATION:

If necessary sample pH is adjusted to neutral and chlorine is removed by reaction with sodium sulphite.

ANALYTICAL PROCEDURE:

Oxygen depletion is measured as the difference in dissolved oxygen (DO) concentration. DO readings are taken prior to sample storage, and also at the end of storage in the dark at 20^0C for five days (BOD5). If necessary, dilutions are made with aerated, nutrient-enriched water to obtain 25-75% oxygen depletion. If the sample has undergone any of the sample preparation steps listed above or if the sample is an industrial waste, a sewage seed is added. For such samples, calculation of an appropriate seed correction is required.

INSTRUMENTATION:

-YSI Model 52 DO meter (Yellow Springs Instrument Company) with DO probe equipped with stirrer and fitted with a Teflon membrane of 0.5 mil thickness which is permeable to oxygen (1 mil = 0.001 inch).
-Titration equipment for Winkler analysis of dissolved oxygen.
-Incubator (19-21^{0}C); BOD bottles (300 mL)

REPORTING:

Max. Significant Figures: 3	Current W value: 0.2	Current T value: 1.0	Full Scale: 9.0 mg/L

OXYGEN DEMAND, BIOCHEMICAL cont'd

CALIBRATION (DO):

The standard is air-saturated reverse osmosis deionized water. The DO content is read from a table (ORBISPHERE LABORATORIES - Pressure/temperature/dissolved oxygen table) after measuring the temperature and the barometric pressure in the laboratory.

CONTROLS:

Calibration (DO)	2 QC solutions of Pure-DW water which have been partially stripped of DO by flushing with nitrogen. These "solutions", of different but unknown DO, are compared using the oxygen meter and the Winkler titration procedure. The difference between the values for the two analytical methods is utilized as a slope control for the DO Analyzer.
Recovery (BOD5)*	3 Recovery standards prepared from a combination of Glucose and Glutamic Acid e.g. R1; the expected BOD5 is 67% of the oxygen requirement for complete oxidation.
Drift	Air saturated Pure-DW water after every 24 samples.
Blanks*	Pure-DW water and BOD dilution water

NOTES:

*These solutions are incubated for five days alongside samples.

Oxygen Demand, Biochemical (E3182)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 9.00 mg/L as O_2

Calibration Control

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	106	0.000	0.008	0.008	0.067
B	106	0.000	0.008	0.008	0.055

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.067
	Within Runs	0.055
	Between/Within	1.218

Control Limits

Control Standard	Control Limits
A	± 0.250
B	± 0.250

Duplicates For BOD's

Number	Concentration	Std. Dev.	% Coeff of Var	Control Limits
60	0.0 - 1.8	0.059	11.808	± 0.31
8	1.9 - 4.5	0.079	2.859	± 0.31
8	4.6 - 9.0	0.075	1.089	± 0.31
76	Total	0.063	4.474	± 0.31

Duplicates For BODC's

Number	Concentration	Std. Dev.	% Coeff of Var	Control Limits
70	0.0 - 1.8	0.033	6.994	± 0.31
6	1.9 - 4.5	0.061	2.220	± 0.31
2	4.6 - 9.0	0.110	1.782	± 0.31
78	Total	0.039	5.002	± 0.31

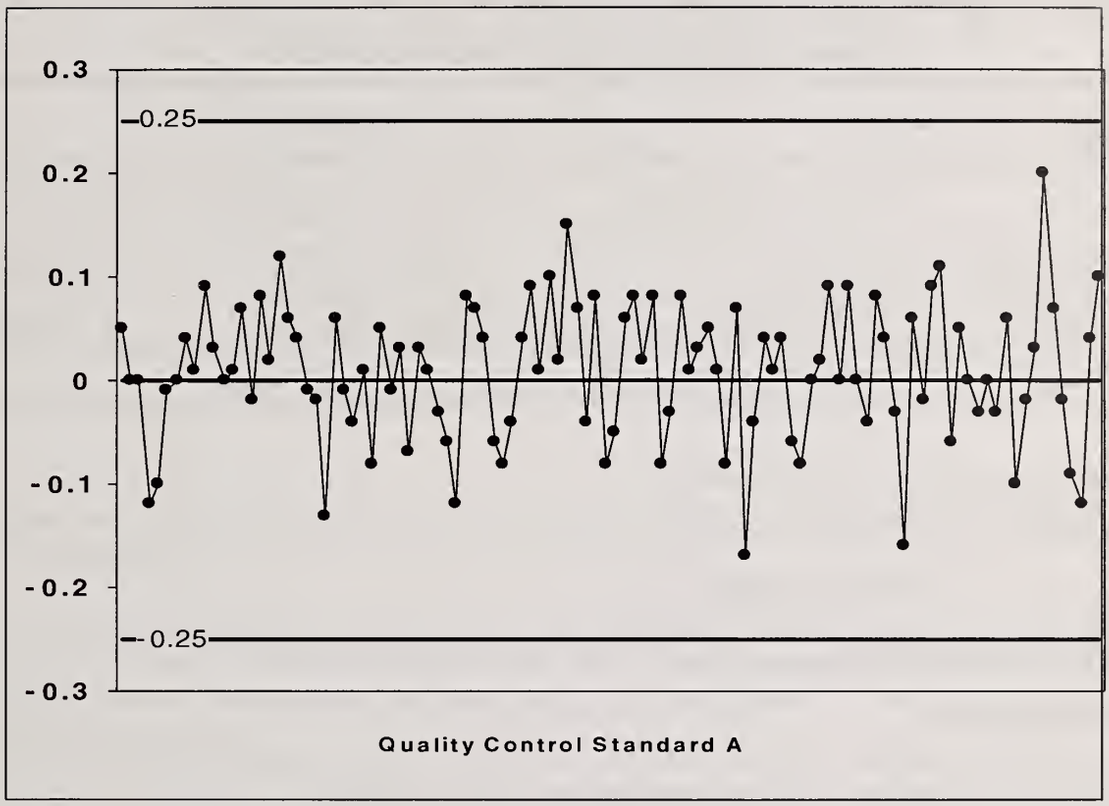
Recoveries

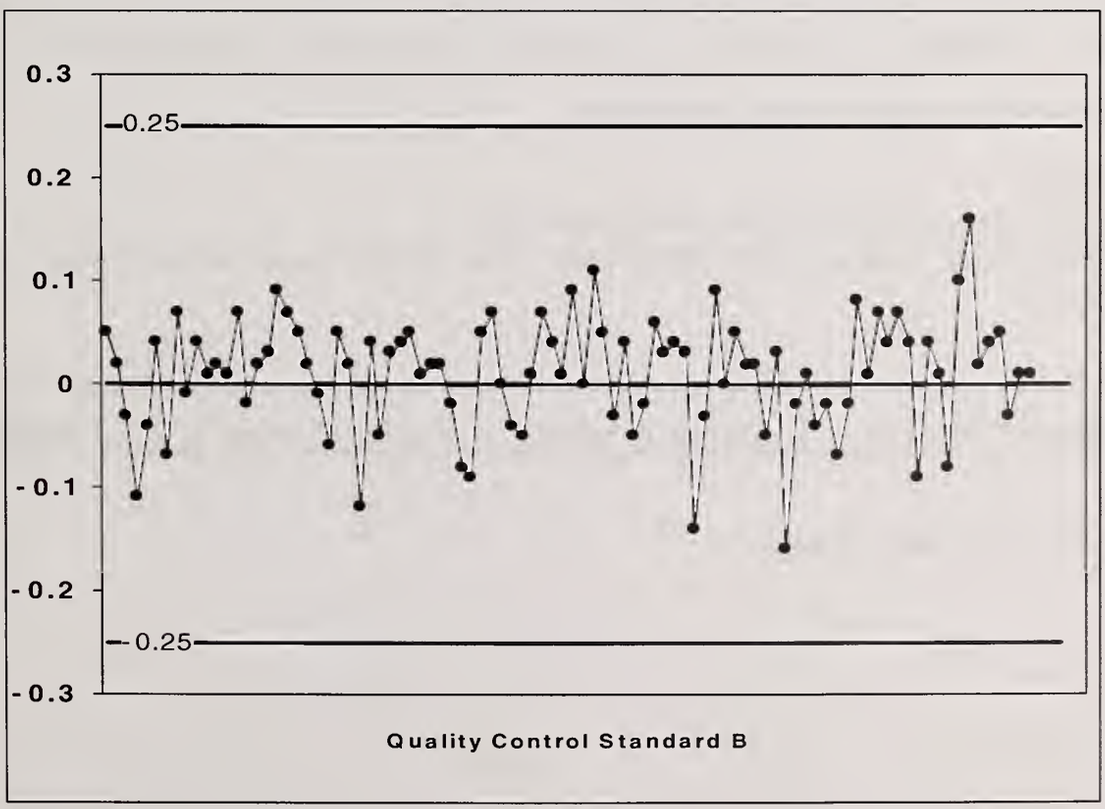
	Number	Expected	Mean	Mean Bias	Std. Dev.	Control Limits
R1	53	2.170	2.193	0.023	0.185	1.74 – 2.60
R2	53	4.340	4.555	0.215	0.250	3.69 – 4.99
R3	53	6.540	6.673	0.133	0.241	5.87 – 7.17

Other Checks

	Number	Expected	Mean	Std. Dev.	Control Limits
Pure-DW Blank, 5-Day	53	0.000	0.155	0.154	± 0.25
BOD Blank, 5-Day	53	0.000	0.117	0.151	± 0.25

Oxygen Demand, Biochemical (E3182)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 9.00 mg/L as O_2





OXYGEN DEMAND, CHEMICAL

ACCREDITATION & DRINKING-WATER LICENSING STATUS

ACCREDITED ☑	Licensed (Drinking Water) ☑
	Drinking Water Standard (SDWA): N/A

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/07/82
Method Reference No.	E3170	Reporting Unit	mg/L as O_2
LIMS Product Code	COD3170	Supervisor	P. Wilson
Sample Type/Matrix	Drinking Water, Ground Water, Surface Water		

SAMPLING:

Quantity Required	50 mL
Container	Glass or plastic
Preservative(s)	None

ANALYTICAL PROCEDURE:

Samples (10.0 mL) are mixed with an acidified potassium dichromate solution which contains mercuric sulphate to suppress chloride interference. After adding concentrated sulphuric acid containing silver sulphate as a catalyst, the mixture is digested in a mechanical-convection oven for 3 hours at 149^{O}C. Analysis is completed by automated colourimetric measurement of trivalent chromium.

Approximate absorbance: 0.05 at the full scale level.

INSTRUMENTATION:

-Culture tubes with Teflon caps, mechanical-convection oven

-Basic automated modular continuous flow system with colourimetric measurement through a 5.0 cm. light path at 600 nm.

REPORTING:

Max. Significant Figures: 3	Current W value: 1	Current T value: 5	Full Scale: 50mg/L

CALIBRATION:

3 digested BL plus 3 digested standards

OXYGEN DEMAND, CHEMICAL cont'd

CONTROLS:

Calibration	2 digested standards, e.g. QCA, QCB
Drift	Digested BL, Drift Control(s), standard in run QCA, in run QCB, and digested BL every 10 samples
Recovery	2 digested standards, e.g. R1
Interference	Digested standard (40 mg/L as O_2) spiked with 50 mg/L Cl confirms suppression of chloride interference.

NOTES:

In order to retard sample decomposition the first reagent (acidified dichromate) is added as soon as possible at the laboratory.

The recovery standard is a material known to be very difficult to digest. The expected recovery is approximately 85%, based on long term experience. We continue to use this material in spite of the poor recovery, because if the slightest problem exists with the digestion step, the recovery falls off sharply to approximately 10%.

Oxygen Demand, Chemical (E3170)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 50.00 mg/L as O_2

Calibration Control

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	21	40	40.004	0.004	1.253
B	21	10	10.07	0.07	1.003
A + B		50	50.075	0.075	1.645
A - B		30	29.934	-0.066	1.564

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	1.135
	Within Runs	1.106
	Between/Within	1.026

Control Limits

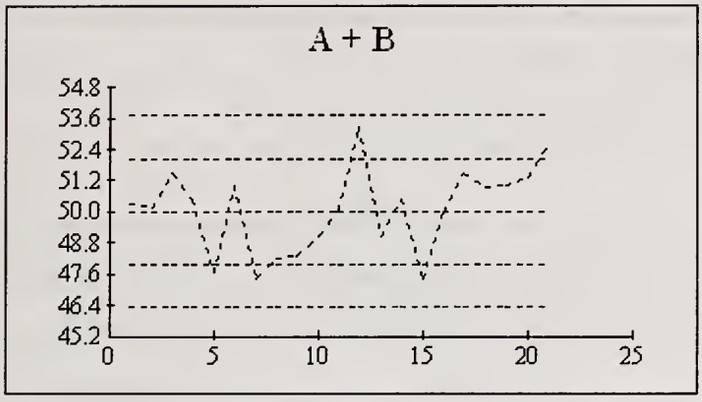
Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	52.000	48.000	53.700	46.300
A - B	32.000	28.000	32.800	27.200

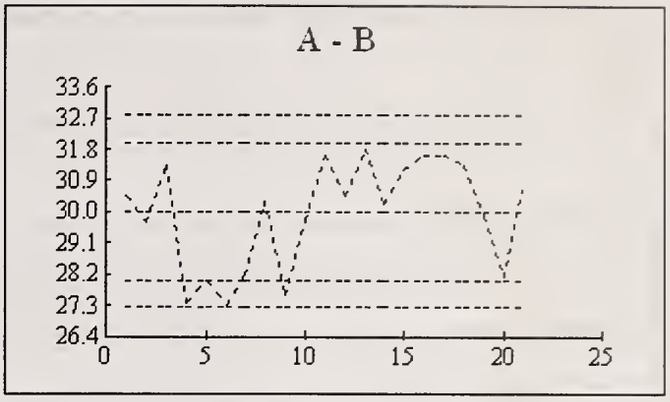
Duplicates

Number	Concentration	Std. Dev.	% Coeff of Var
28	0 - 10%	1.352	43.548
17	10 - 20%	1.218	18.246
13	20 - 50%	1.549	10.091
3	50 - 100%	1.096	3.211
62	Total	1.34	13.01

Oxygen Demand Chemical (E3170)

QC Data; 1/1/2008 to 12/31/2008





OXYGEN DEMAND, CHEMICAL

ACCREDITATION & DRINKING-WATER LICENSING STATUS

ACCREDITED ☑	Licensed (Drinking Water) N/A
	Drinking Water Standard (SDWA): N/A

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/07/82
Method Reference No.	E3246	Reporting Unit	mg/L as O_2
LIMS Product Code	COD3246	Supervisor	P. Wilson
Sample Type/Matrix	Raw Sewage, Industrial Waste, Ground Water, Leachate, Effluent, Sludge, Surface Water, Process Water		

SAMPLING:

Quantity Required	50 mL
Container	Glass or plastic
Preservative(s)	None

ANALYTICAL PROCEDURE:

Samples (10.0 mL) are mixed with an acidified potassium dichromate solution which contains mercuric sulphate to suppress chloride interference. After adding concentrated sulphuric acid containing silver sulphate as a catalyst, the mixture is digested in a mechanical-convection oven for 3 hours at 149^{O}C. Analysis is completed by automated colourimetric measurement of trivalent chromium.

Approximate absorbance: 0.6 at the full scale level.

INSTRUMENTATION:

Basic automated modular continuous flow system with colourimetric measurement through a 5.0 cm. light path at 600 nm.

REPORTING:

Max. Significant Figures: 3	Current W value: 2	Current T value: 10	Full Scale: to 500 mg/L

CALIBRATION:

2 digested BL plus 4 digested standards

ONTROLS:

Calibration	2 digested standards, e.g. QCA, QCB
Drift	Digested BL, Drift Control(s), Standard in run QCA, in run QCB, and Digested BL every 10 samples
Recovery	2 digested standards, e.g. R1
Interference	Digested standard (50 mg/L as O_2) spiked with 900 mg/L Cl confirms suppression of chloride interference.

OTES:

n order to retard sample decomposition the first reagent (acidified dichromate) is added as soon as possible at the laboratory.

The recovery standard is a material known to be very difficult to digest. The expected recovery is approximately 85%, based on long term experience. We continue to use this material in spite of the poor recovery, because if the slightest problem exists with the digestion step, the recovery falls off sharply to approximately 10%.

Oxygen Demand, Chemical (E3246)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 500.0 mg/L as O_2

Calibration Control

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	27	400	397.691	2.309	3.525
B	27	100	99.219	0.781	3.645
A + B		500	496.91	3.09	4.722
A - B		300	298.473	1.527	5.396

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	3.585
	Within Runs	3.816
	Between/Within	0.939

Control Limits

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	510.000	490.000	522.500	477.500
A - B	310.000	290.000	315.000	285.000

Duplicates

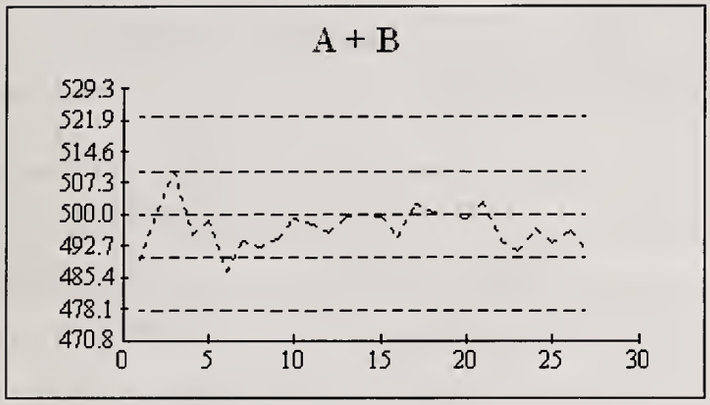
Number	Concentration	Std. Dev.	% Coeff of Var
71	0 - 10%	2.467	17.779
10	10 - 20%	2.372	4.402
0	20 - 50%	NA	NA
0	50 - 100%	NA	NA
81	Total	2.455	13.048

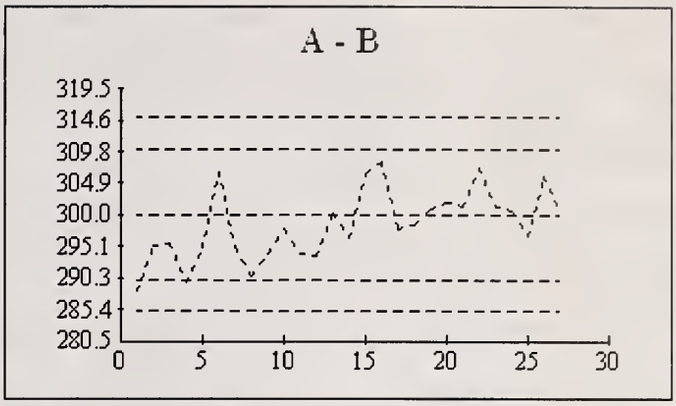
Recoveries

Number	Expected	Mean	Std. Dev.	%CV	Control Limits
54	400.0	386.297	7.580	1.962	375-425
54	100.0	94.741	3.704	3.909	90-110
26	200.0	205.40	8.123	3.955	±41

Oxygen Demand Chemical (E3246)

QC Data; 1/1/2008 to 12/31/2008





pH

ACCREDITATION & DRINKING-WATER LICENSING STATUS

ACCREDITED ☑	Licensed (Drinking Water) ☑
	Drinking Water Standard (SDWA): N/A

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	09/07/80
Method Reference No	E3218	Reporting Units	Dimensionless
LIMS Product Code	PHALCO3218, CONDPH3218	Supervisor	P. Wilson
Sample Type/Matrix	Sludge, Effluent, Industrial Waste, Raw Sewage, Drinking Water, Ground Water, Leachate, Precipitation, Surface Water		

SAMPLING:

Quantity Required	50 mL
Container	Glass or Plastic
Preservative(s)	None

ANALYTICAL PROCEDURE:

pH is directly measured on a stirred sample (30.0 mL) at room temperature. Stirring rate, tube size, degree of electrode immersion, and room temperature range are uniform for all samples and standards.

Total fixed endpoint alkalinity, and conductivity are determined simultaneously.

INSTRUMENTATION:

Automated modular titration system with computer control and data processing software.

REPORTING:

Max. Significant Figures: 3	Full Scale: 14.00 dimensionless

CALIBRATION:

2 standard buffers covering the pH range of 4 to 9

CONTROLS:

Calibration	2 QC standards e.g. QCA, QCB
Drift	In-run standards throughout the run (diluted tap water 50% V/V)

pH (E3218)
Quality Control Data
2008/1/1 to 2008/12/31

Calibration Control

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	117	7.410	7.409	-0.001	0.018
B	117	4.450	4.506	0.056	0.022
A + B		11.860	11.914	0.054	0.032
A - B		2.960	2.903	-0.057	0.024

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.014
	Within Runs	0.012
	Between/Within	1.167

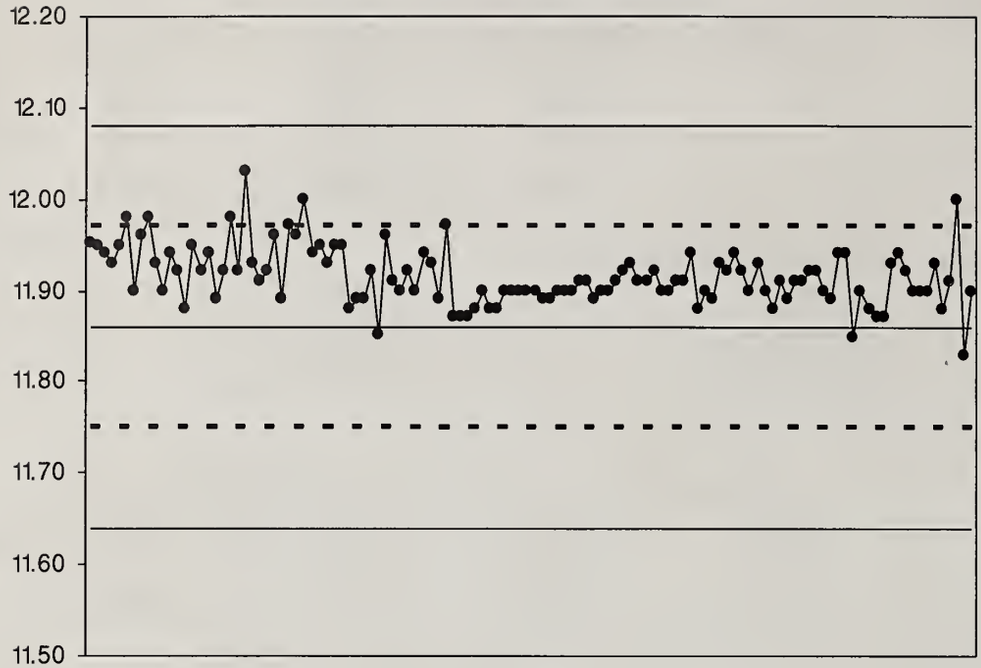
Control Limits

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	11.970	11.750	12.080	11.640
A - B	3.070	2.850	3.130	2.790

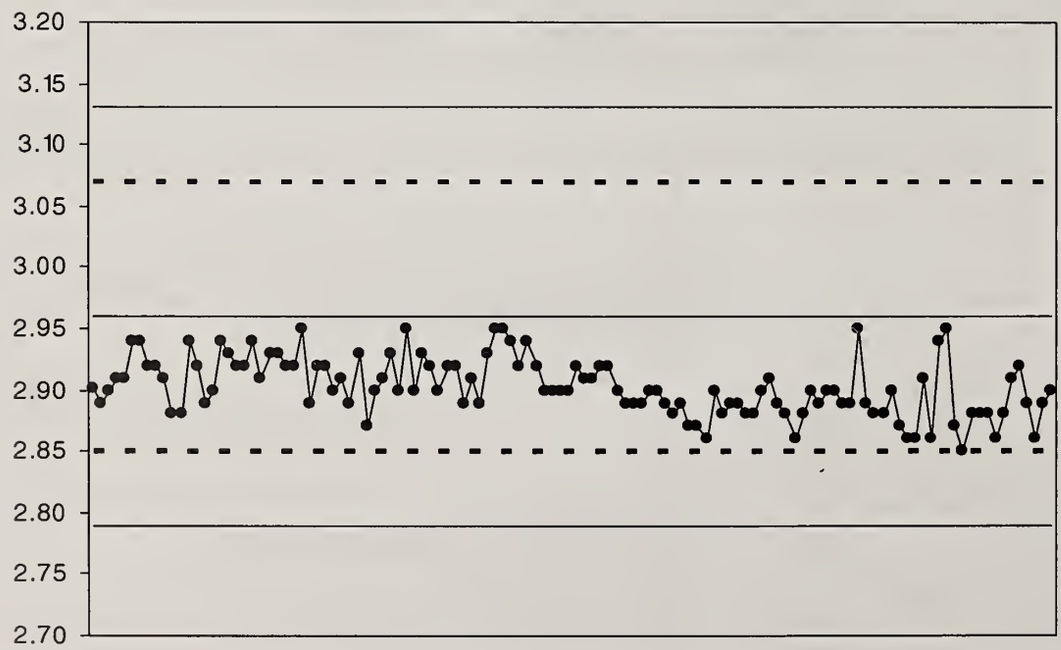
Duplicates

Number	Concentration	Std. Dev.	% Coeff of Var
10	1.00 - 7.00	0.065	1.295
95	7.01 - 8.00	0.070	0.064
227	8.01 - 12.00	0.048	0.042
332	Total	0.068	0.041

pH (E3218)
Quality Control Data
2008/1/1 to 2008/12/31



Quality Control Standard A + B



Quality Control Standard A - B

PHENOLICS, REACTIVE

ACCREDITATION & DRINKING-WATER LICENSING STATUS

ACCREDITED ☑	Licensed (Drinking Water) ☑
	Drinking Water Standard (SDWA): N/A

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/74
Method Reference No.	E3179	Reporting Unit	µg/L as Phenol
LIMS Product Code	PHEN3179	Supervisor	P.Wilson
Sample Type/Matrix	Ground Water, Surface Water, Effluent, Drinking Water, Leachate, Raw Sewage, Industrial Waste, Process Water, Precipitation		

SAMPLING:

Quantity Required	250 mL
Container	Glass, (Phenol bottle with white cap containing preservative is available)
Preservative	Sulphuric acid to pH 1.5 - 2

ANALYTICAL PROCEDURE:

Samples are automatically distilled from an acid media, and reactive phenolics in the distillate are determined colourimetrically by formation of an antipyrene dye through reactions with 4-aminoantipyrene and potassium ferricyanide.
Approximate absorbance: 0.03 at the full scale level.

INSTRUMENTATION:

Basic automated modular continuous flow system plus a distillation module. Colourimetric measurement is through a 5.0 cm. light path at 505 nm. Data capture and processing via a Data Acquisition System.

REPORTING:

Max. Significant Figures: 3	Current W value: 0.2	Current T value: 1.0	Full Scale: 50 µg/L

CALIBRATION:

BL plus 2 standards

CONTROLS:

Calibration	LTBL plus 2 standards, e.g. QCA, QCB, QCC
Drift	BL ,standard , Drift Control(s), BL every 10 samples

Phenolics; 4-AAP (E3179)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 50.0 µg/L as Phenol

Calibration Control

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	31	40.000	39.797	0.203	0.309
B	31	10.000	10.085	0.085	0.176
C	31	5.000	5.239	0.239	0.176
A + B		50.000	49.882	0.118	0.434
A - B		30.000	29.712	0.288	0.255
B + C		15.000	15.324	0.324	0.246
B - C		5.000	4.846	0.154	0.253

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.252
	Within Runs	0.180
	Between/Within	1.400
s.d.(BC)	Between Runs	0.176
	Within Runs	0.179
	Between/Within	0.983

Control Limits

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	50.965	49.035	51.930	48.070
A - B	30.965	29.035	31.448	28.552
B + C	15.464	14.536	15.928	14.072
B - C	5.464	4.436	5.696	4.304

Duplicates

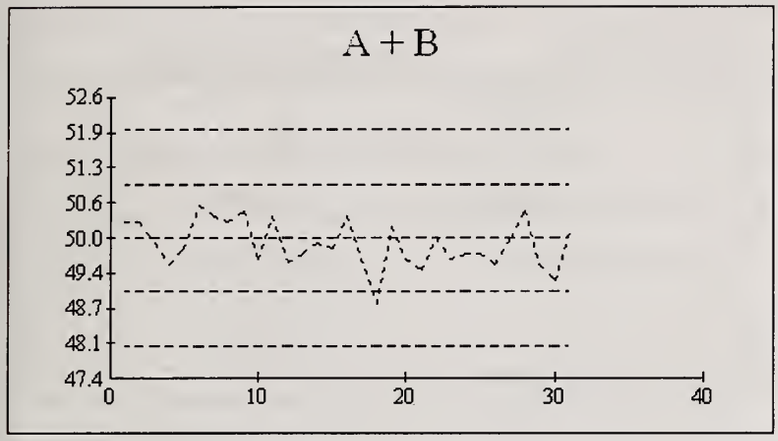
Number	Concentration	Std. Dev.	% Coeff of Var
61	0 - 10%	0.145	14.656
4	10 - 20%	0.197	2.452
3	20 - 50%	0.122	0.686
2	50 - 100%	NA	NA
70	Total	0.156	5.396

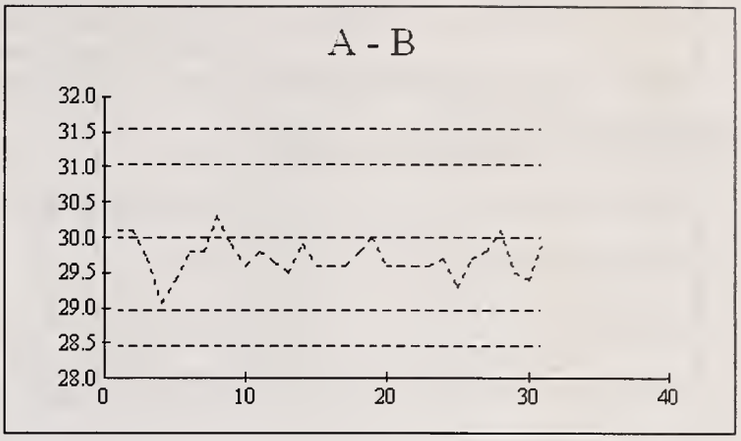
Other Checks

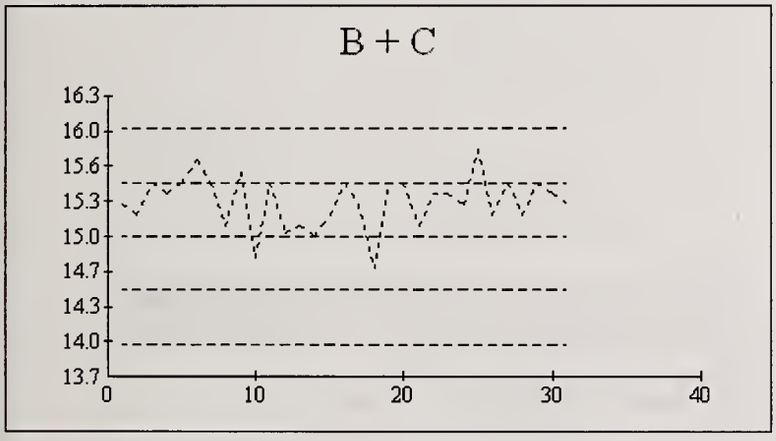
	Number	Mean	Std. Dev.
LTB	31	0.174	0.570

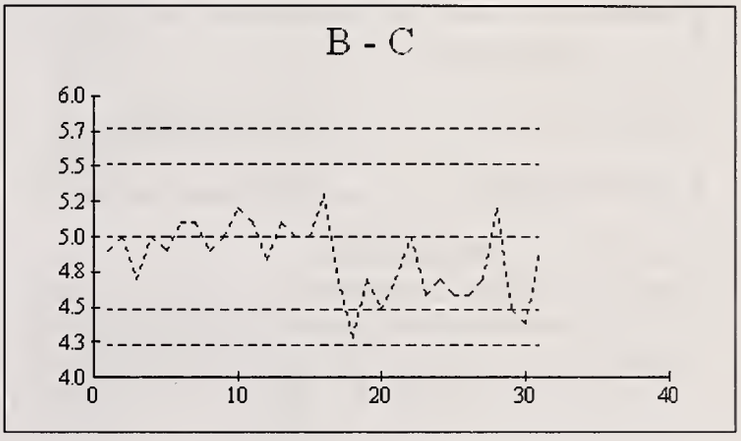
Phenolics; 4-AAP (E3179)

QC Data; 1/1/2008 to 12/31/2008









PHOSPHOROUS, REACTIVE ortho-PHOSPHATE

ACCREDITATION & DRINKING-WATER LICENSING STATUS

ACCREDITED ☑	Licensed (Drinking Water) ☑
	Drinking Water Standard (SDWA): N/A

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/79
Method Reference No.	E3364	Reporting Unit	mg/L as P
LIMS Product Code	DISNUT3364	Supervisor	P.Wilson
Sample Type/Matrix	Drinking Water, Precipitation, Surface Water		

SAMPLING:

Quantity Required	10 mL
Container	Glass or plastic
Preservative(s)	None

ANALYTICAL PROCEDURE:

Ortho-phosphate is determined on the supernatant of a settled sample by formation of the reduced phospho-antimonyl-molybdate complex using ascorbic acid as the reducing agent.
Approximate absorbance: 0.2 at the full scale level.
Ammonia plus ammonium, nitrite, and nitrate plus nitrite are determined simultaneously.

INSTRUMENTATION:

Basic automated modular continuous flow system with colourimetric measurement through a 5.0 cm. light path at 880 nm using IR sensitive phototube.
Data capture and processing is via a computer system.

REPORTING:

Max. Significant Figures: 3	Current W value: 0.0005	Current T value: 0.0025	Full Scale: 0.100 mg/L

CALIBRATION:

BL plus 7 standards

CONTROLS:

Calibration	LTBL plus 3 standards, e.g. QCA, QCB, QCC
Drift	BL ,standard , Drift Control(s), and BL after every 20 samples

Phosphorus; Phosphate (E3364)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 0.1.00 mg/L as P

Calibration Control

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	133	0.08	0.0807	0.0007	0.0009
B	133	0.04	0.04	0	0.0009
C	133	0.008	0.0077	-0.0003	0.0006
A + B		0.12	0.1207	0.0007	0.0014
A - B		0.04	0.0406	0.0006	0.0011
B + C		0.048	0.0478	-0.0002	0.0011
B - C		0.032	0.0323	0.0003	0.0011

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.0009
	Within Runs	0.0008
	Between/Within	1.125
s.d.(BC)	Between Runs	0.0008
	Within Runs	0.0008
	Between/Within	1

Control Limits

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	0.1224	0.1176	0.1248	0.1152
A - B	0.0424	0.0376	0.0436	0.0364
B + C	0.0496	0.0464	0.0512	0.0448
B - C	0.0336	0.0304	0.0344	0.0296

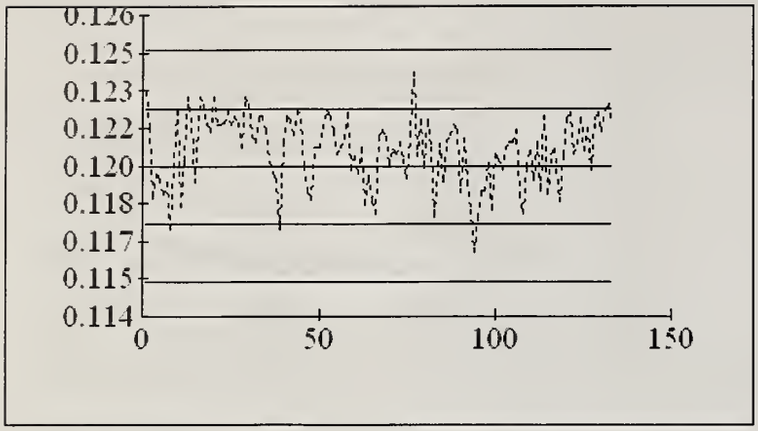
Duplicates

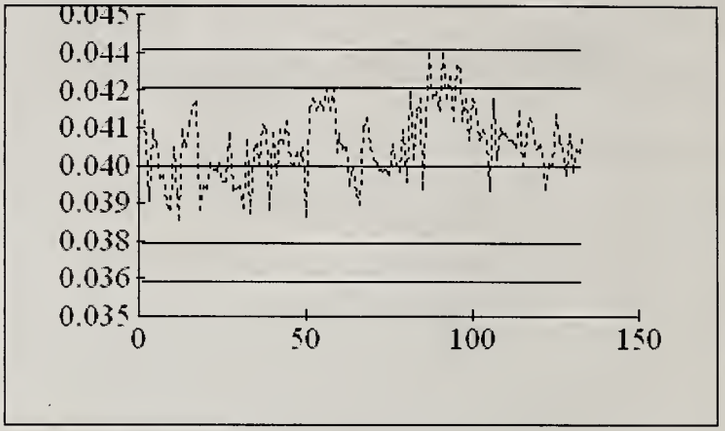
Number	Concentration	Std. Dev.	% Coeff of Var
285	0 - 10%	0.002	87.2
37	10 - 20%	0.001	7.1
31	20 - 50%	0.002	6.4
13	50 - 100%	0.003	4.8
366	Total	0.002	24.7

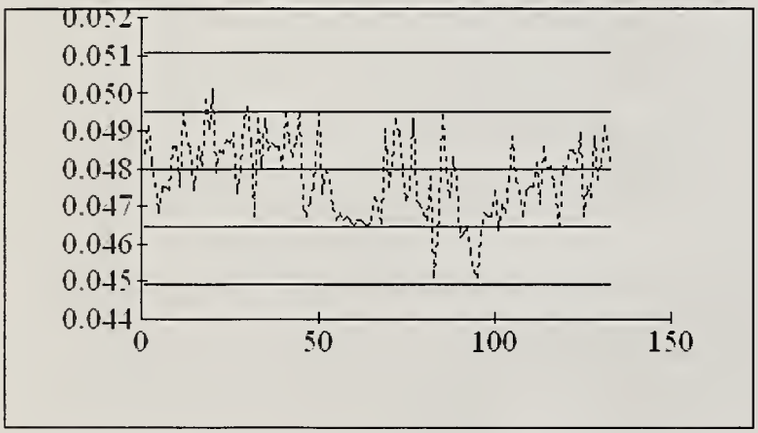
Other Checks	Number	Mean	Std. Dev.
LTB	130	0.0003	0.001

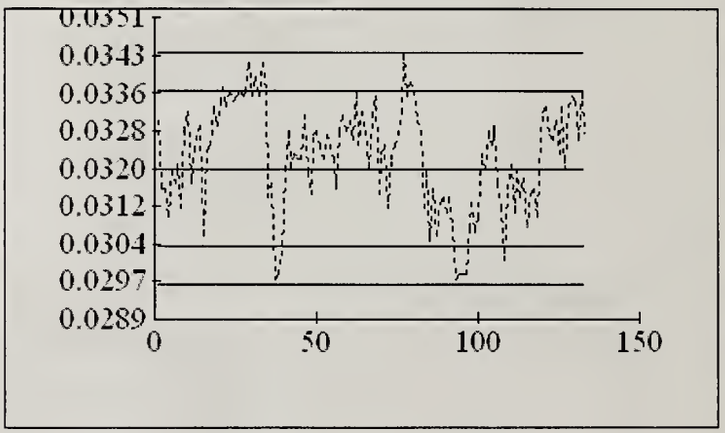
Phosphorus; phosphate (E3364)

QC Data: 1/1/2008 to 12/31/2008









PHOSPHORUS, REACTIVE ortho-PHOSPHATE

ACCREDITATION & DRINKING-WATER LICENSING STATUS

ACCREDITED ☑	Licensed (Drinking Water) N/A
	Drinking Water Standard (SDWA): N/A

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/79
Method Reference No	E3366	Reporting Unit	mg/L as P
LIMS Product Code	DISNUT3366	Supervisor	P.Wilson
Sample Type/Matrix	Sludge, Effluent, Raw Sewage, Industrial Waste, Process Water, Leachate, Ground Water, Surface Water.		

SAMPLING:

Quantity Required	10 mL
Container	Glass or plastic
Preservative(s)	None

ANALYTICAL PROCEDURE:

Ortho-phosphate is determined on the supernatant of a settled sample by formation of the reduced phospho-antimonyl-molybdate complex using ascorbic acid as the reducing agent.
Approximate absorbance: 0.5 at the full scale level.
Ammonia plus ammonium, nitrite, and nitrate plus nitrite are determined simultaneously.

INSTRUMENTATION:

Basic automated modular continuous flow system with colourimetric measurement through a 5.0 cm. light path at 880 nm using IR sensitive phototube.
Data capture and processing is via a computer system.

REPORTING:

Max. Significant Figures: 3	Current W value: 0.02	Current T value: 0.10	Full Scale: 10 mg/L

CALIBRATION:

BL plus 7 standards

CONTROLS:

Calibration	LTBL plus 3 standards, e.g. QCA, QCB, QCC
Drift	BL ,standard, Drift Control(s), and BL every 20 samples

Phosphorus; Phosphate (E3366)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 10.00 mg/L as P

Calibration Control

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	74	8	8.041	0.041	0.028
B	74	4	3.98	0.02	0.026
C	74	0.8	0.811	0.011	0.008
A + B		12	12.021	0.021	0.033
A - B		4	4.061	0.061	0.043
B + C		4.8	4.79	0.01	0.028
B - C		3.2	3.169	0.031	0.026

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.027
	Within Runs	0.03
	Between/Within	0.9
s.d.(BC)	Between Runs	0.019
	Within Runs	0.018
	Between/Within	1.056

Control Limits

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	12.14	11.86	12.29	11.71
A - B	4.14	3.86	4.22	3.78
B + C	4.87	4.73	4.94	4.66
B - C	3.27	3.13	3.31	3.09

Duplicates

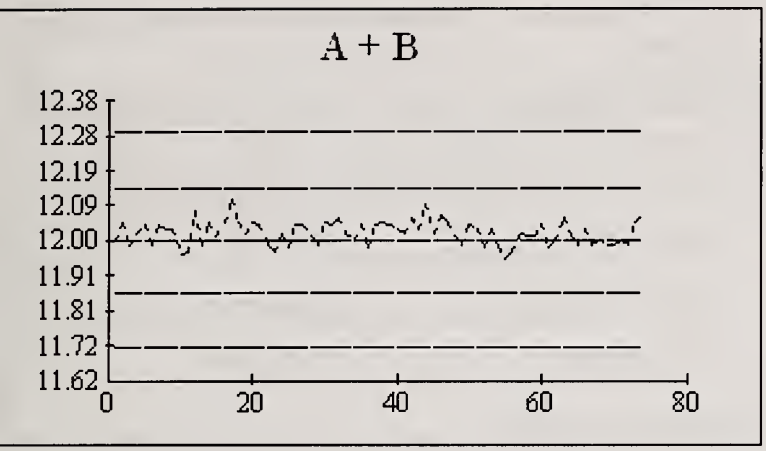
Number	Concentration	Std. Dev.	% Coeff of Var
154	0 - 10%	0.01	9.445
2	10 - 20%	NA	NA
2	20 - 50%	NA	NA
2	50 - 100%	NA	NA
160	Total	0.014	5.204

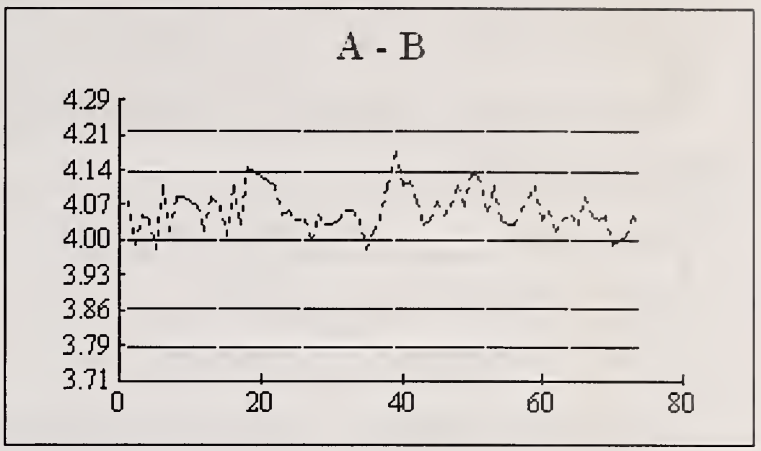
Other Checks

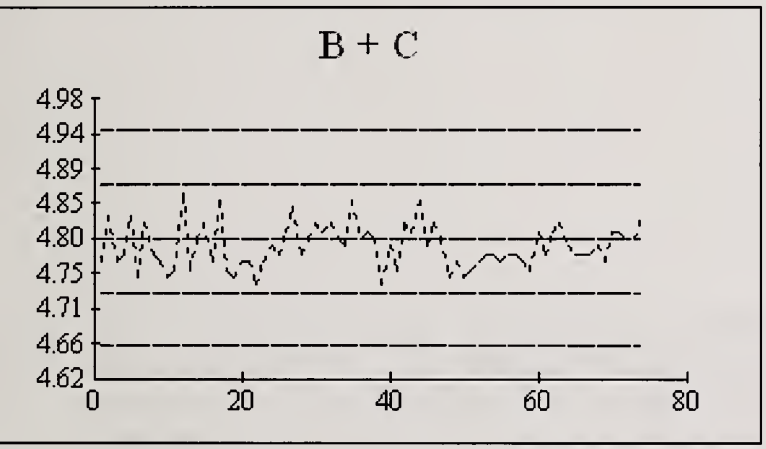
	Number	Mean	Std. Dev.
LTB	74	-0.015	0.007

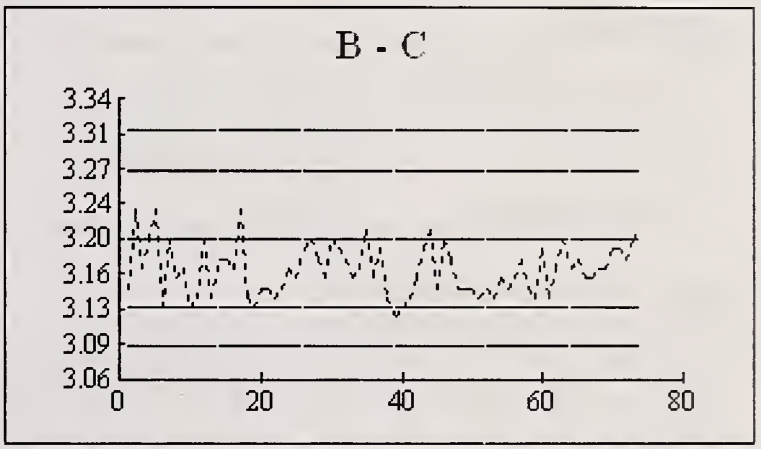
Phosphorus; phosphate (E3366)

QC Data; 1/1/2008 to 12/31/2008









PHOSPHORUS, TOTAL

ACCREDITATION & DRINKING-WATER LICENSING STATUS

ACCREDITED ☑	Licensed (Drinking Water) N/A
	Drinking Water Standard (SDWA): N/A

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	Mar '89
Method Reference No.	E3116	Reporting Unit	mg/g as P
LIMS Product Code	TNP3116	Supervisor	P. Wilson
Sample Type/Matrix	Soil, Sediment, Dried Sludge and vegetation		

SAMPLING:

Quantity Required	0.08 to 0.4 g
Container	Glass or plastic
Preservative(s)	None

ANALYTICAL PROCEDURE:

Phosphorus compounds are converted to orthophosphate by dissolution of the samples in hot sulphuric acid and potassium persulphate. Potassium persulphate is added later in the digestion to raise the boiling point and to provide a highly oxidizing environment to decompose the more resistant organic matter. The digestate is filtered and the filtrate is analyzed using an automated colourimetric system.
Total Kjeldahl Nitrogen is determined simultaneously.

INSTRUMENTATION:

Hot plate
Basic automated modular continuous flow system: Colourimetric measurement is through a 5 cm. light path at 660 nm.
Data capture and processing is via a computer system

REPORTING:

Max. Significant Figures: 3	Current W value: 0.02	Current T value: 0.10	Full Scale: 2.0 mg/L

CALIBRATION:

3 High and 2 Low Calibration Standards

CONTROLS:

Drift	Drift Control(s), 80% calibration standard for every 10 samples
Recovery	3 digested BL's plus 4 digested standards R1, R2, R3 and R4

PHOSPHORUS, TOTAL cont'd

NOTES:

System is calibrated with undigested standards. QCA, QCB and QCC were introduced in April 2003. February 2004, Method E3118 was amalgamated with E3116. Data capture/processing is done by the "Labtronics" data acquisition software.

Phosphorus; Total (E3116)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 2.00 mg/L as P

Calibration Control

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	18	1.6	1.597	-0.003	0.01
B	18	0.8	0.799	-0.001	0.007
C	18	0.2	0.198	-0.002	0.005
A + B		2.4	2.396	-0.004	0.012
A - B		0.8	0.797	-0.003	0.012
B + C		1	0.998	-0.002	0.007
B - C		0.6	0.601	0.001	0.01

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.009
	Within Runs	0.008
	Between/Within	1.125
s.d.(BC)	Between Runs	0.006
	Within Runs	0.007
	Between/Within	0.857

Control Limits

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	2.432	2.368	2.464	2.336
A - B	0.832	0.768	0.848	0.752
B + C	1.015	0.985	1.030	0.970
B - C	0.615	0.585	0.622	0.578

Duplicates

Number	Concentration	Std. Dev.	% Coeff of Var
0	0 - 10%	NA	NA
3	10 - 20%	0.046	12.8
22	20 - 50%	0.047	6.7
13	50 - 100%	0.044	3.5
49	Total	0.064	4.9

Recoveries

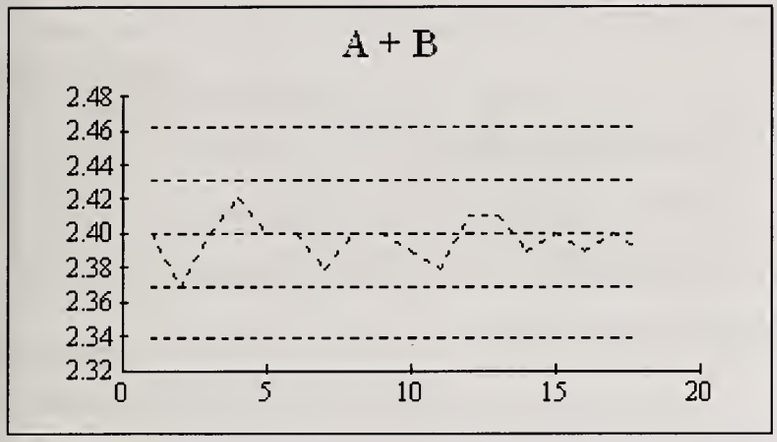
Number	*Expected*	*Mean*	*Mean Bias*	*Std. Dev.*
18	1.05	1.034	-0.016	0.033
18	0.47	1.279	0.809	0.308
18	24	24.191	0.191	1.205

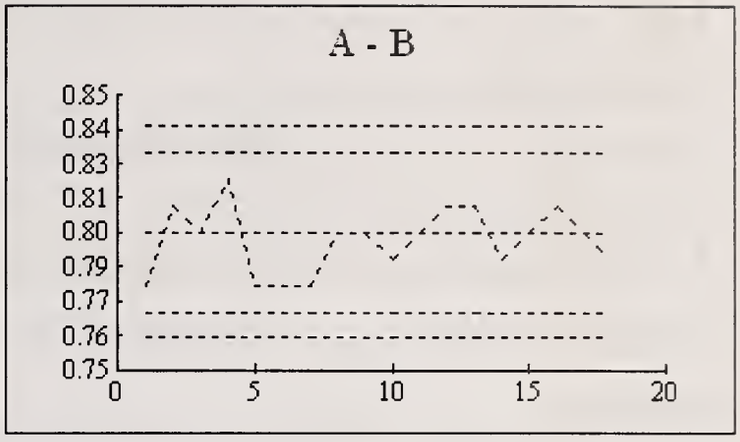
Other Checks

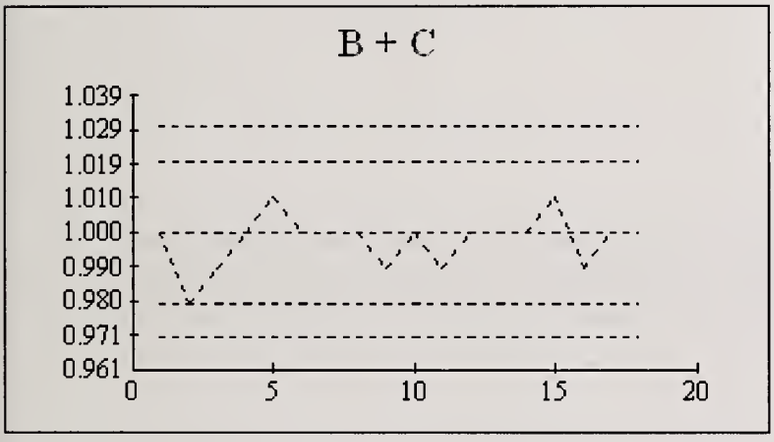
	Number	Mean	Std. Dev.
LTB	18	0.004	0.01
Digested Blank	18	0.013	0.012

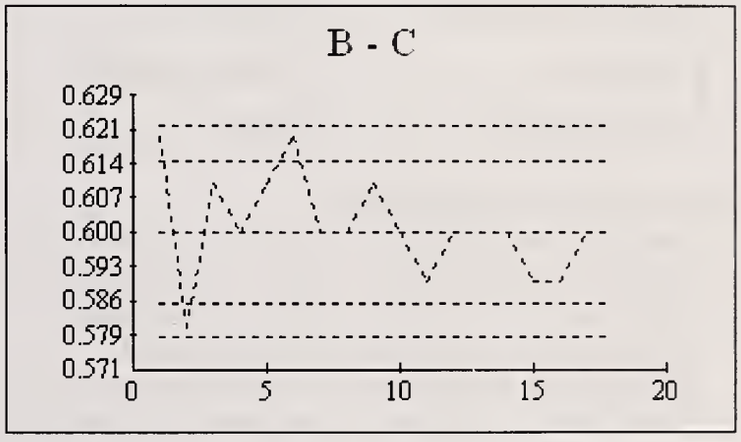
Phosphorus; total (E3116)

QC Data; 1/1/2008 to 12/31/2008









PHOSPHORUS, TOTAL

ACCREDITATION & DRINKING-WATER LICENSING STATUS

ACCREDITED ☑	Licensed (Drinking Water) ☑
	Drinking Water Standard (SDWA): N/A

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/79
Method Reference No	E3367	Reporting Unit	mg/L as P
LIMS Product Code	TOTNUT3367	Supervisor	P.Wilson
Sample Type/Matrix	Precipitation, Drinking Water, Surface Water		

SAMPLING:

Quantity Required	50 mL
Container	Glass or plastic
Preservatives	None

ANALYTICAL PROCEDURE:

Samples are digested in a sulphuric acid-mercuric oxide-potassium sulphate media using three block digesters kept at 180^0C, 210^0C and 360^0C. The pH of the digestate is adjusted in-line and then orthophosphate is determined by formation of the reduced phospho-antimonyl-molybdate complex using ascorbic acid as the reducing agent.
Approximate absorbance: 0.4 at the full scale level.
Total Kjeldahl nitrogen is determined simultaneously.

INSTRUMENTATION:

Three Block digesters
Basic automated modular continuous flow system with colourimetric measurement through a 5.0 cm. light path at 880 nm using appropriate phototube.
Data capture and processing is via a computer system

REPORTING:

Max. Significant Figures: 3	Current W value: 0.002	Current T value: 0.010	Full Scale: 0.200 mg/L

CALIBRATION:

BL plus 7 undigested standards

PHOSPHORUS, TOTAL cont'd

CONTROLS:

Calibration	LTBL plus 3 undigested standards, e.g. QCA, QCB, QCC
Drift	BL , Drift Control(s), undigested standard , BL every 20 samples
Recovery	3 digested BL plus 3 digested standards in duplicate, e.g. R1

NOTES:

System is calibrated with undigested standards

Phosphorus; Total (E3367)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 0.200 mg/L as P

Calibration Control

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	98	0.160	0.160	0.000	0.001
B	98	0.080	0.080	0.000	0.001
C	98	0.016	0.016	0.000	0.001
A + B		0.240	0.240	0.000	0.001
A - B		0.080	0.080	0.000	0.001
B + C		0.096	0.096	0.000	0.001
B - C		0.064	0.064	0.000	0.001

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.001
	Within Runs	0.001
	Between/Within	1.000
s.d.(BC)	Between Runs	0.001
	Within Runs	0.001
	Between/Within	1.000

Control Limits

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	0.2434	0.2366	0.2468	0.2332
A - B	0.0834	0.0766	0.0858	0.0749
B + C	0.0980	0.0940	0.1000	0.0920
B - C	0.0660	0.0620	0.0670	0.0610

Duplicates

Number	Concentration	Std. Dev.	% Coeff of Var
223	0 - 10%	0.002	24.385
34	10 - 20%	0.004	14.616
9	20 - 50%	0.011	19.527
8	50 - 100%	0.003	2.166
274	Total	0.003	18.791

Recoveries

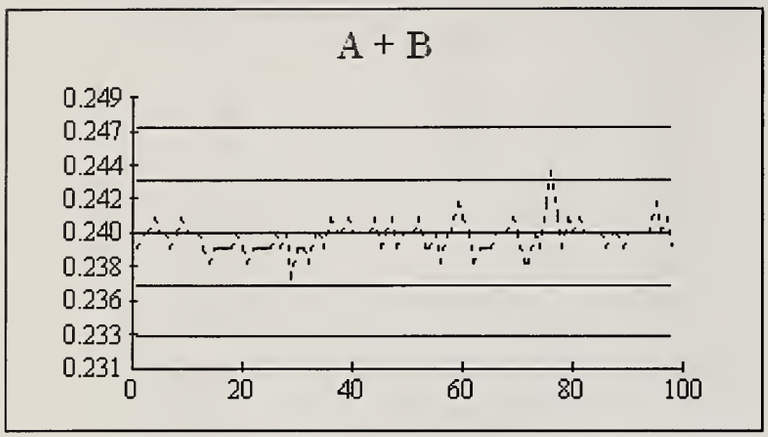
	Number	Expected	Mean	Mean Bias	Std. Dev.
R1	98	0.14	0.138	-0.002	0.006
R2	98	0.084	0.084	0	0.004
R3	97	0.028	0.028	0	0.001

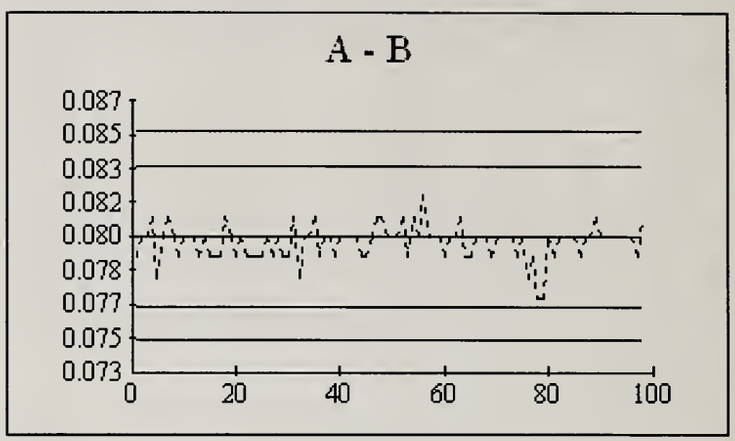
Other Checks

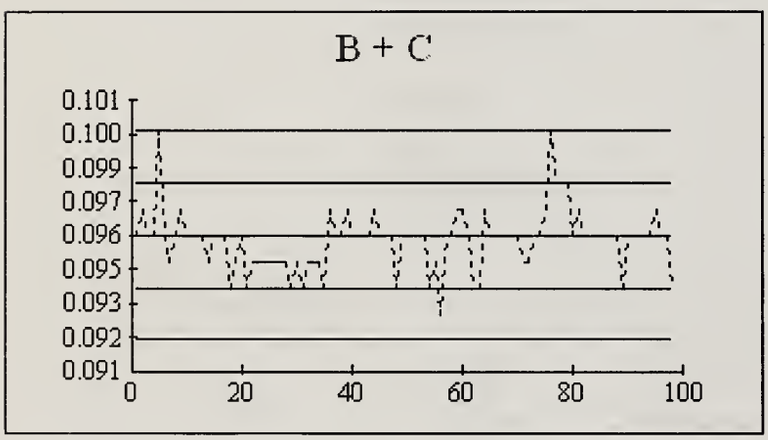
	Number	Mean	Std. Dev.
LTB	98	0	0.001
Digested Blank	98	0	0.001

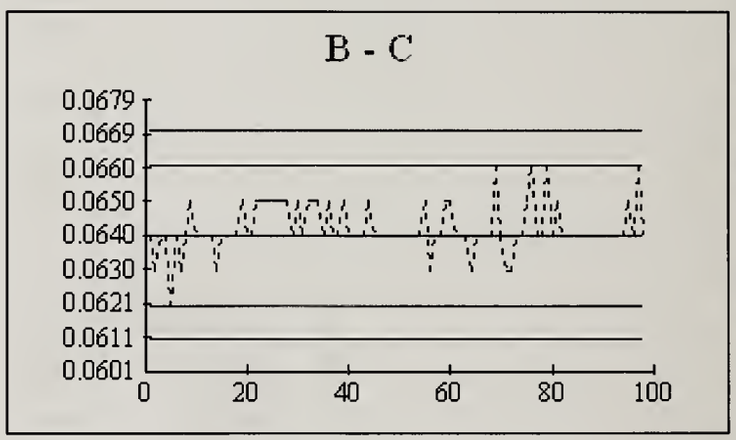
Phosphorus; total (E3367)

QC Data; 1/1/2008 to 12/31/2008









PHOSPHORUS, TOTAL

ACCREDITATION & DRINKING-WATER LICENSING STATUS

ACCREDITED ☑	Licensed (Drinking Water) N/A
	Drinking Water Standard (SDWA): N/A

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/79
Method Reference No.	E3368	Reporting Unit	mg/L as P
LIMS Product Code	TOTNUT3368	Supervisor	P. Wilson
Sample Type/Matrix	Sludge, Raw Sewage, Industrial Waste, Effluent, Ground Water, Process Water, Leachate, Precipitation, Surface Water.		

SAMPLING:

Quantity Required	50 mL
Container	Glass or plastic
Preservative(s)	None

ANALYTICAL PROCEDURE:

Samples are digested in a sulphuric acid-mercuric oxide-potassium sulphate media using three block digestors kept at 180^{0}C, 210^{0}C and 360^{0}C. The pH of the digestate is adjusted in-line and then orthophosphate is determined by formation of the reduced phospho-antimonyl-molybdate complex using ascorbic acid as the reducing agent.
Approximate absorbance: 0.8 at the full scale level.
Total Kjeldahl Nitrogen is determined simultaneously.

INSTRUMENTATION:

3-Block digesters
Basic automated modular continuous flow system with colourimetric measurement through a 5.0 cm. light path at 880 nm using an IR sensitive phototube. Data capture and processing is via a computer system.

REPORTING:

Max. Significant Figures: 3	Current W value: 0.02	Current T value: 0.10	Full Scale: 10.0 mg/L

CALIBRATION:

BL plus 7 standards

PHOSPHORUS, TOTAL cont'd

CONTROLS:

Calibration	LTBL plus 3 standards, e.g. QCA, QCB, QCC
Drift	BL ,undigested standard, BL every 20 samples
Recovery	3 digested BL plus 3 digested standards in duplicate, e.g. R1

NOTES:

System is calibrated with undigested standards.

Phosphorus; Total (E3368)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 10.00 mg/L as P

Calibration Control

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	43	8.000	8.008	0.008	0.030
B	43	4.000	3.996	-0.004	0.017
C	43	0.800	0.811	0.011	0.009
A + B		12.000	12.004	0.004	0.031
A - B		4.000	4.012	0.012	0.038
B + C		4.800	4.807	0.007	0.019
B - C		3.200	3.184	-0.016	0.020

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.024
	Within Runs	0.027
	Between/Within	0.889
s.d.(BC)	Between Runs	0.014
	Within Runs	0.014
	Between/Within	1.000

Control Limits

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	12.065	11.935	12.130	11.870
A - B	4.065	3.935	4.097	3.903
B + C	4.834	4.766	4.868	4.732
B - C	3.234	3.166	3.251	3.149

Duplicates

Number	Concentration	Std. Dev.	% Coeff of Var
99	0 - 10%	0.051	53.175
4	10 - 20%	0.016	1.165
2	20 - 50%	NA	NA
1	50 - 100%	NA	NA
106	Total	0.050	18.844

Recoveries

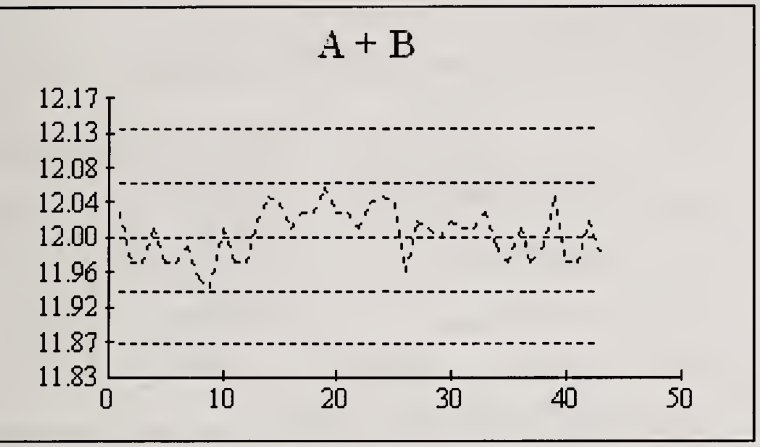
	Number	Expected	Mean	Mean Bias	Std. Dev.
R1	43	7	6.849	-0.151	0.110
R2	43	4.2	4.163	-0.037	0.101
R3	43	1.4	1.381	-0.019	0.110

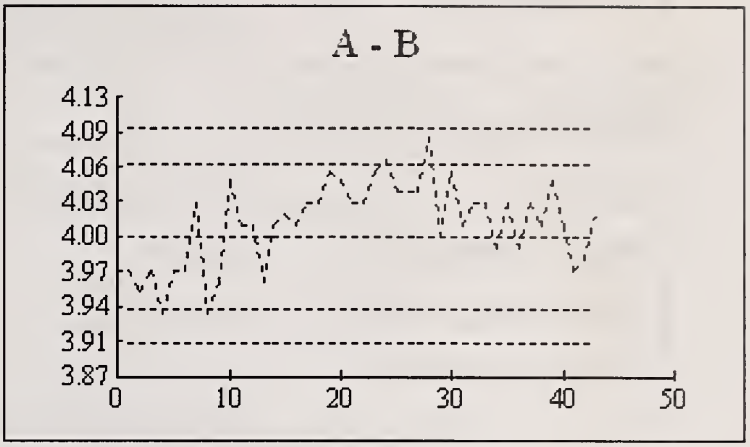
Other Checks

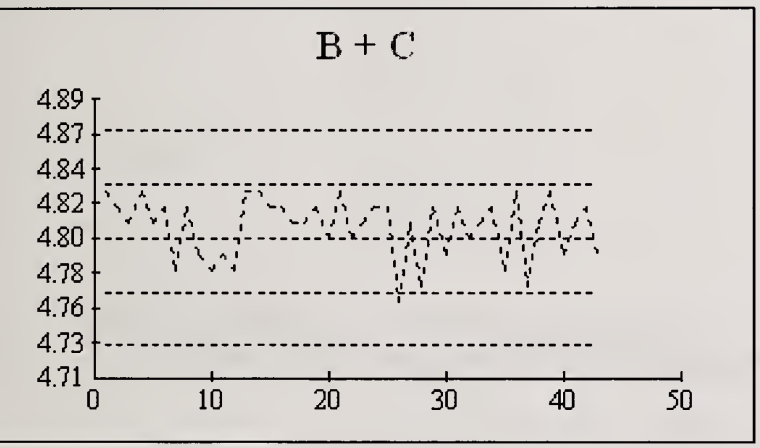
	Number	Mean	Std. Dev.
LTB	43	-0.007	0.017
Digested Blank	43	-0.004	0.027

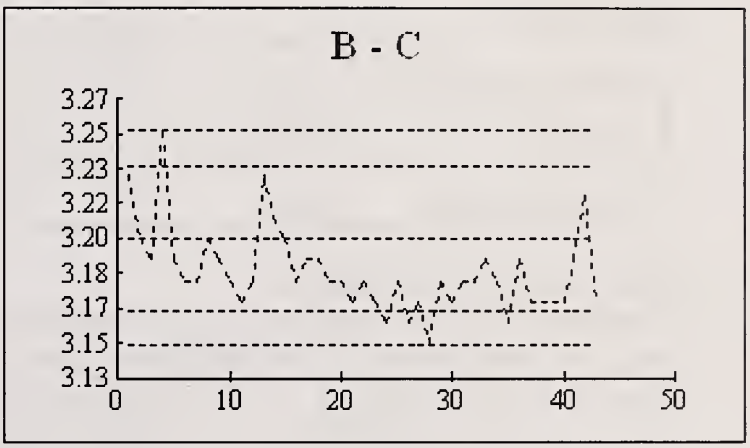
Phosphorus; total (E3368)

QC Data; 1/1/2008 to 12/31/2008









SILICON, REACTIVE SILICATES

ACCREDITATION & DRINKING-WATER LICENSING STATUS

ACCREDITED ☑	Licensed (Drinking Water) ☑
	Drinking Water Standard (SDWA): N/A

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/02/75
Method Reference No.	E3370	Reporting Unit	mg/L as Si
LIMS Product Code	DCSI3370	Supervisor	P.Wilson
Sample Type/Matrix	Effluent, Industrial Waste, Process Water, Raw Sewage, Drinking Water Ground Water, Leachates, Precipitation, Surface Water		

SAMPLING:

Quantity Required	10 mL
Container	Plastic
Preservative(s)	None

ANALYTICAL PROCEDURE:

Reactive silicates are determined by formation of a reduced molybdo-silicate complex at pH 1.6, using ascorbic acid as the reducing agent, and oxalic acid to suppress phosphate interference.
Approximate absorbance: 0.7 at the full scale level.
Dissolved inorganic and dissolved organic carbon are determined simultaneously.

INSTRUMENTATION:

Basic automated modular continuous flow system with colourimetric measurement through a 5.0 cm. light path at 660 nm. Data capture and processing is via a computer system.

REPORTING:

Max. Significant Figures: 3	Current W value: 0.02	Current T value: 0.10	Full Scale: 10.0 mg/L

CALIBRATION:

BL plus 7 standards

CONTROLS:

Calibration	LTBL plus 3 standards, e.g., QCA, QCB, QCC
Drift	BL, Drift Control(s), standard and BL every 20 samples.

Silicon; Reactive Silicate (E3370)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 10.00 mg/L as Si

Calibration Control

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	77	8.000	7.965	-0.035	0.040
B	77	2.000	1.998	-0.002	0.015
C	77	0.500	0.477	-0.023	0.009
A + B		10.000	9.962	-0.038	0.049
A - B		6.000	5.967	-0.033	0.035
B + C		2.500	2.475	-0.025	0.021
B - C		1.500	1.521	0.021	0.013

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.030
	Within Runs	0.025
	Between/Within	1.200
s.d.(BC)	Between Runs	0.012
	Within Runs	0.009
	Between/Within	1.333

Control Limits

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	10.170	9.830	10.340	9.660
A - B	6.170	5.830	6.250	5.750
B + C	2.570	2.430	2.630	2.370
B - C	1.570	1.430	1.600	1.400

Duplicates

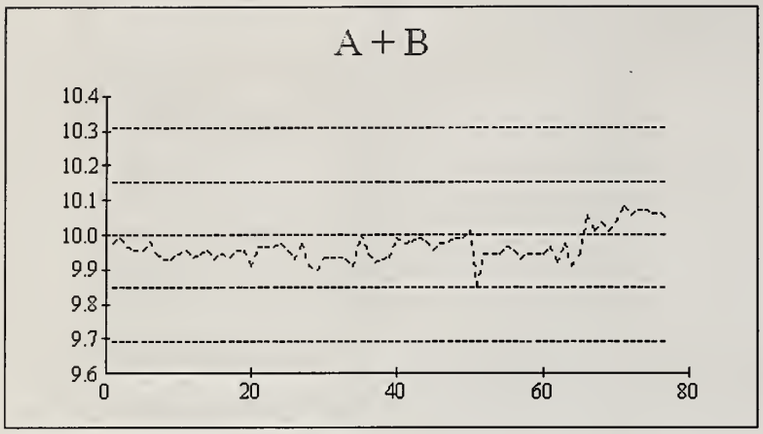
Number	Concentration	Std. Dev.	% Coeff of Var
87	0 - 10%	0.007	1.629
54	10 - 20%	0.009	0.644
57	20 - 50%	0.012	0.383
16	50 - 100%	0.011	0.168
214	Total	0.009	0.486

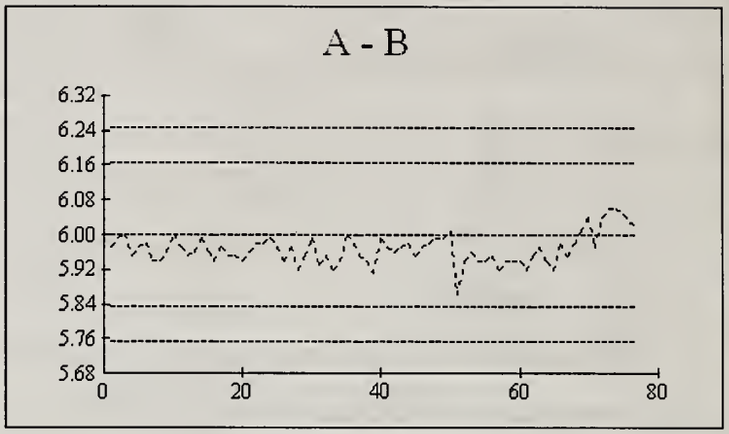
Other Checks

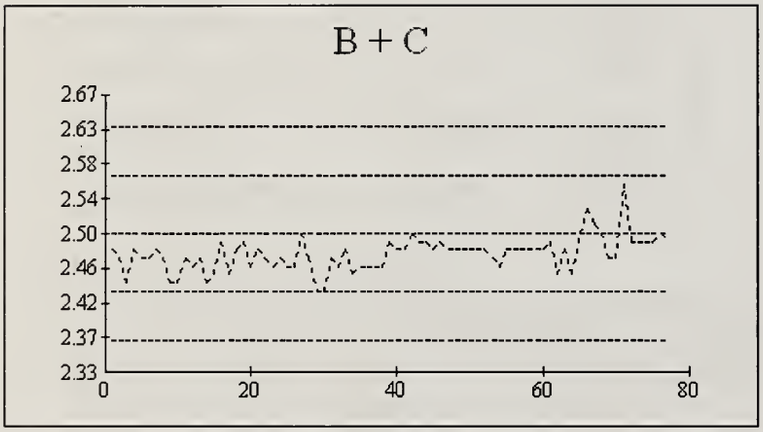
	Number	Mean	Std. Dev.
LTB	77	-0.035	0.015

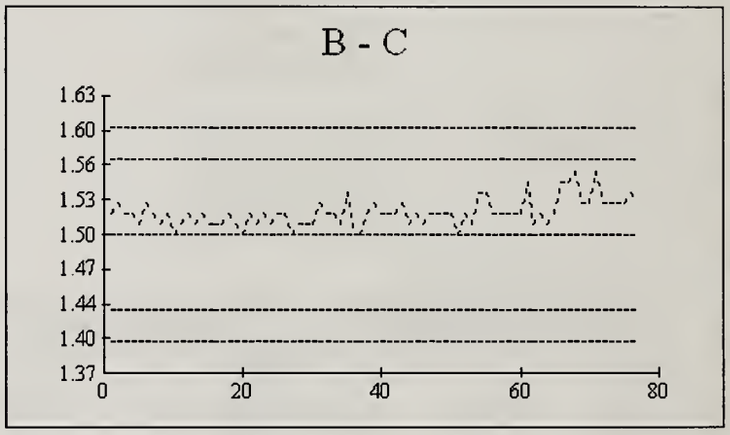
Silicon; reactive silicate (E3370)

QC Data: 1/1/2008 to 12/31/2008









SOLIDS, DISSOLVED

ACCREDITATION & DRINKING-WATER LICENSING STATUS

ACCREDITED ☑	Licensed (Drinking Water) ☑
	Drinking Water Standard (SDWA): N/A

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	Before '61
Method Reference No.	E3188	Reporting Unit	mg/L
LIMS Product Code	TSD3188,DS3188	Supervisor	P. Wilson
Sample Type/Matrix	Effluent, Raw Sewage, Industrial Waste, Process Water, Surface Water, Drinking Water, Ground Water, Leachate		

SAMPLING:

Quantity Required	125 mL – 200 mL
Container	Glass or plastic
Preservative(s)	None

ANALYTICAL PROCEDURE:

Sample is filtered under moderate suction through a Whatman 934AH grade glass fibre filter. Generally 100 mL of filtrate (alternate 50 mL) is pipetted into a preweighed Teflon dish, dried at 103±2^{0}C, and stored in a desiccator for at least 24 hours. The dissolved solids content is calculated by subtracting the original dish mass from the dried residue + dish mass. Data collection, calculations, and transfer of results to LIMS are controlled by a computer system.

INSTRUMENTATION:

Balance (4 decimal places), drying oven, suction filtration apparatus, dishes (Teflon).
Computer system with appropriate software.

REPORTING:

Max. Significant Figures: 3	Current W value: 10	Current T value: 50	Full Scale: N/A

CALIBRATION:

Balance zero
Balance internal calibration is performed daily.

CONTROLS:

Calibration	2 S class weights, e.g. QCA & QCB (results in grams)
Drift	Balance is reset to zero after every 10 weighings
Recovery	2 standards, e.g. R1 & R3
Method Blank	100 mL Pure Water.

Solids, Dissolved (3188)
Quality Control Data
2008/1/1 to 2008/12/31

Calibration Control

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	60	50.0000	50.0000	0.00000	0.00006
B	60	30.0000	30.0000	0.00003	0.00005
A + B		80.0000	80.0000	0.00003	0.00009
A - B		20.0000	20.0000	-0.00003	0.00006

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.00006
	Within Runs	0.00004
	Between/Within	1.50000

Control Limits

Control Standard	Control Limits
A (50)	49.9998 – 50.0002
B (30)	29.9998 – 30.0002
A (0.5)	0.49999 – 0.50001
B (0.05	0.04999 – 0.05001

Duplicates

Number	Concentration	Std. Dev.	% Coeff of Var
21	0 - 500	6.9259	3.2473
78	501 - 1000	8.9814	1.3084
44	1001 - 10 000	28.3841	1.6963
143	Total	31.1697	3.3858

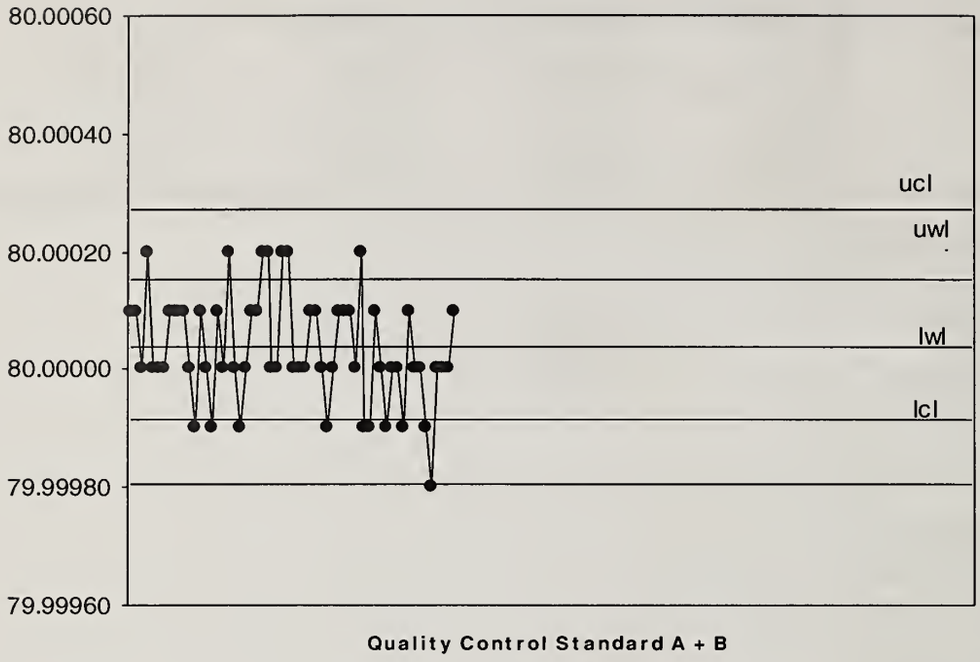
Check Standards

	Number	Expected	Mean	Mean Bias	Std. Dev.	Control Limits
R1 (Kaolin)	60	2000.000	1997.24	-2.76	6.61	1944.82-2019.18
R2 (Kaolin)	60	500.000	498.08	-1.92	4.54	470.85-515.85

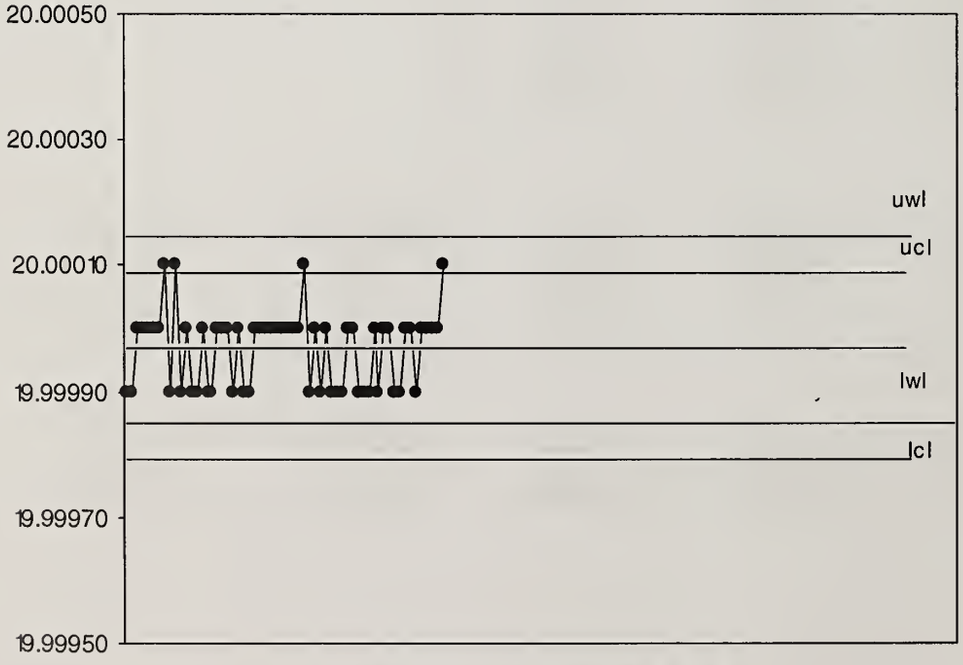
Other Checks

	Number	Expected	Mean	Mean Bias	Std. Dev.
LTB	60	0.00000	0.67633	0.67633	2.25222

Solids, Dissolved (3188)
Quality Control Data
2008/1/1 to 2008/12/31

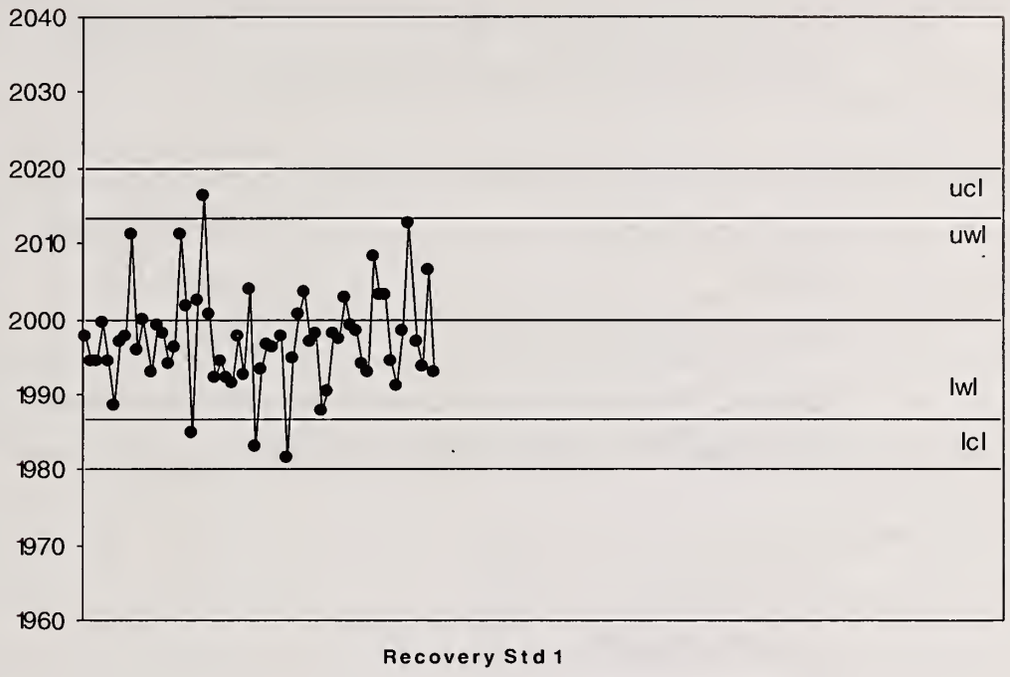


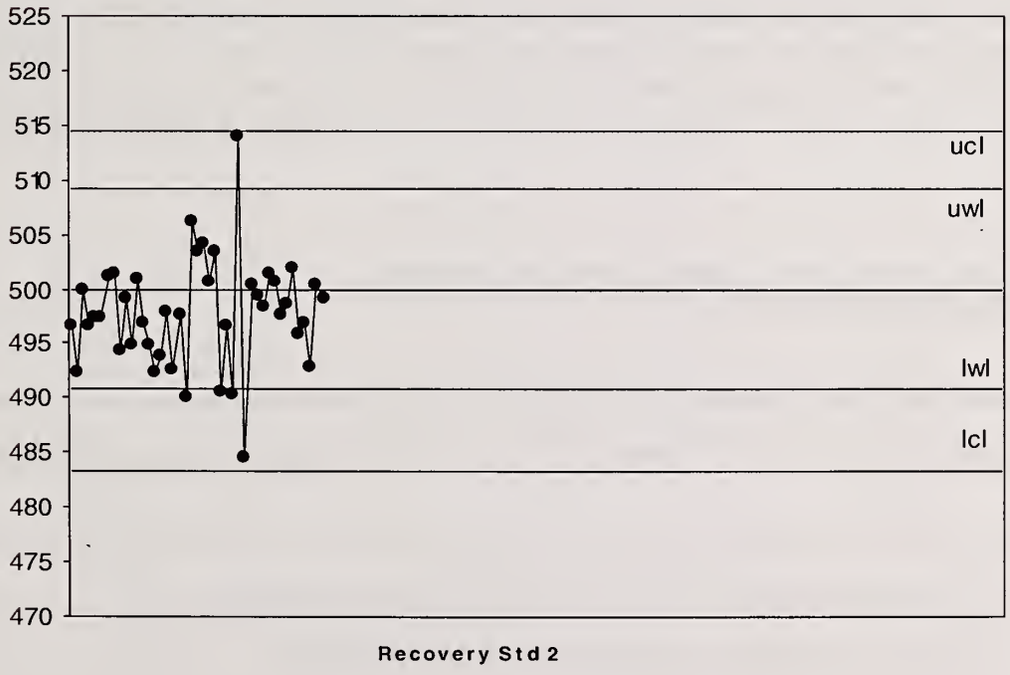
Quality Control Standard A + B



Quality Control Standard A - B

Solids, Dissolved (3188)
Quality Control Data
2008/1/1 to 2008/12/31





SOLIDS, SUSPENDED

ACCREDITATION & DRINKING-WATER LICENSING STATUS

ACCREDITED	☑	Licensed (Drinking Water)	☑
		Drinking Water Standard (SDWA): N/A	

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	Before '81
Method Reference No.	E3188	Reporting Unit	mg/L
LIMS Product Code	TSD3188, SS3188, SIGN	Supervisor	P.Wilson
Sample Type/Matrix	Effluent, Raw Sewage, Industrial Waste, Process Water, Surface Water, Drinking Water, Ground Water, Leachate		

SAMPLING:

Quantity Required	2-500 mL
Container	Glass or plastic
Preservative(s)	None

ANALYTICAL PROCEDURE:

2 to 500 mL is pipetted or quickly poured from a shaken sample into a graduated cylinder, and the volume is measured. The aliquot is then filtered under moderate suction through a preweighed Whatman 934AH glass fibre filter. The graduated cylinder and then the filter are washed with a total of 50 mL distilled water. The filter is dried at 103-105^{0}C, and the suspended solids content is calculated by subtracting the original filter mass from the dried filter mass. Data collection, calculations, and transfer of results to LIMS are controlled by a computer system.

INSTRUMENTATION:

Balance (5-decimal places), drying oven, suction filtration apparatus.
Computer system with appropriate software.

REPORTING:

Max. Significant Figures: 3	Current W value: 0.5	Current T value: 2.5	Full Scale: N/A

CONTROLS:

Calibration	2 S class weights, e.g. QCC & QCD (results in grams)
Drift	Balance is reset to zero after every 10 weighings.
Recovery	2 standards, e.g. R1 & R2
Method Blank	Filter washed with 500 mL distilled water

SOLIDS, SUSPENDED

NOTES:

A correction factor is applied to all filters to account for weight loss during filtering.

Solids, Suspended (3188)

Quality Control Data from 2008/1/1 to 2008/12/31

Calibration Control

	Number	Expected	Mean	Mean Bias	Std. Dev.
C	322	0.50000	0.49999	-0.00001	0.00001
D	322	0.05000	0.05000	0.00000	0.00001
C+D		0.55000	0.55000	0.00000	0.00001
C-D		0.45000	0.45000	0.00000	0.00002

Between Run VS Within Run Standard Deviations

s.d.(CD)	Between Runs	6.10x10-6
	Within Runs	6.23x10-6
	Between/Within	0.97964

Control Limits

Control Standard	Control Limits
C (0.5)	0.49999 – 0.50001
D (0.05)	0.04999 – 0.05001

Duplicates

Number	Concentration	Std. Dev.	% Coeff of Var
494	0.0 - 5.0	0.197	9.866
140	5.0 - 10	0.560	8.153
159	10.0 - 25	0.536	3.446
138	25 - 100	1.448	3.304
29	100 - 500	7.450	4.364
5	500 - 2000	6.722	1.335

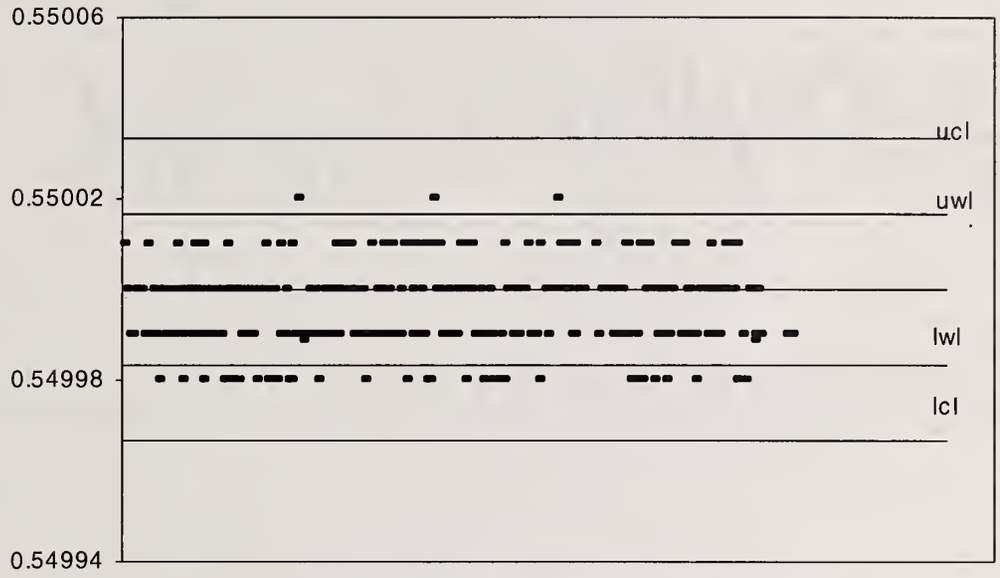
Recovery Standards

	Number	Expected	Mean	Mean Bias	Std. Dev.	Control Limits
R1 (Kaolin)	322	200	195.16	-4.84	1.98	187.3-200.72
R2 (Kaolin)	322	50	48.70	-1.30	0.87	46.79-52.41

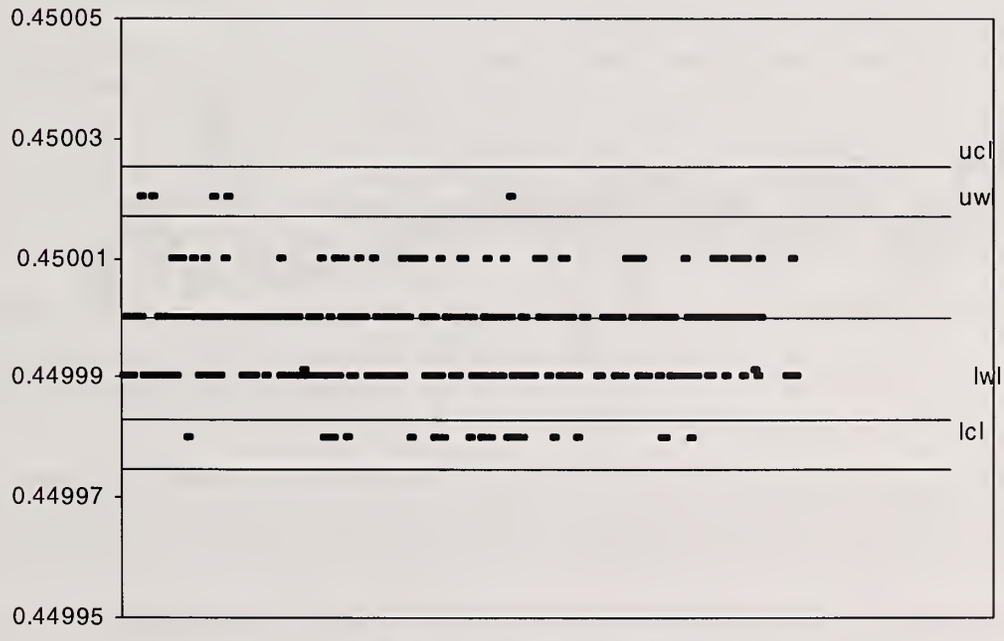
Other Checks

	Number	Expected	Mean	Mean Bias	Std. Dev.
LTB	322	0.000	0.025	0.025	0.112

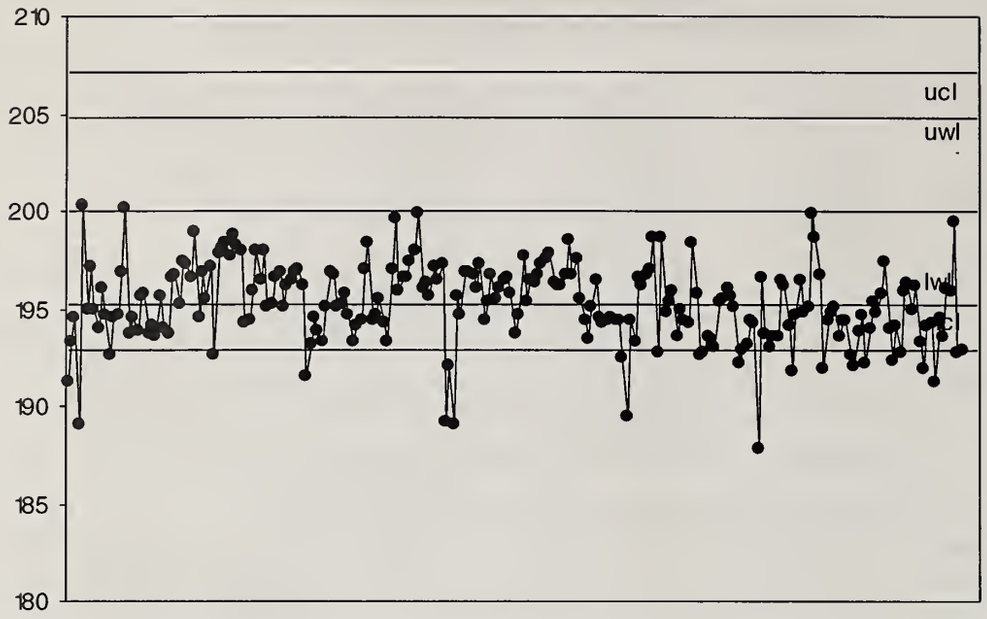
Solids, Suspended (3188)
Quality Control Data from 2008/1/1 to 2008/12/31



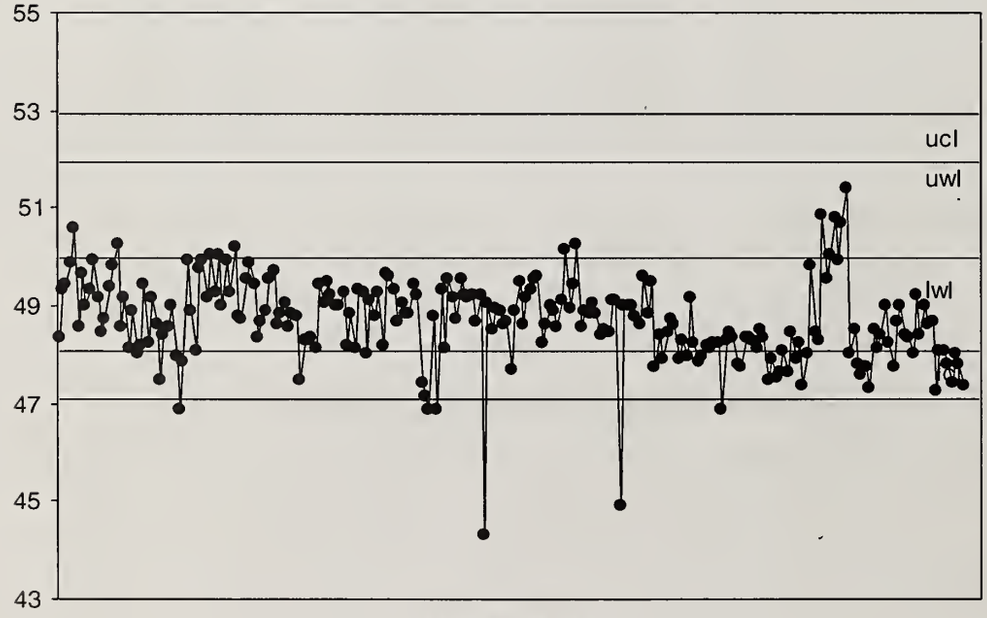
Quality Control Standard C + D



Quality Control Standard C - D



Recovery Std 1



Recovery Std 2

SOLIDS, SUSPENDED IGNITED
(Particulate Ash and Particulate Loss On Ignition)

ACCREDITATION & DRINKING-WATER LICENSING STATUS

ACCREDITED ☑	Licensed (Drinking Water) N/A
	Drinking Water Standard (SDWA): N/A

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	Before '61
Method Reference No.	E3188	Reporting Unit	mg/L
LIMS Product Code	SIGN3188	Supervisor	P. Wilson
Sample Type/Matrix	Effluent, Raw Sewage, Industrial Waste, Process Water		

SAMPLING:

Quantity Required	2-500 mL
Container	Glass or plastic
Preservative(s)	None

ANALYTICAL PROCEDURE:

The procedure for particulate solids (SS3188) is followed and the dried residue is ignited at 600±50^{0}C for one hour in a muffle furnace. The dish is transferred to a desiccator to cool. The particulate ash (fixed solids) is the difference between the final ignited mass plus filter and the original tare weight of the filter, divided by the original sample volume (mL) used for SS3188. The particulate loss on ignition (estimate of volatile suspended solids) is the difference between the final ignited mass plus filter and the residue (suspended solids) plus filter, divided by the original sample volume (mL). Data collection, calculations, and transfer of results to LIMS are controlled by a computer system.

INSTRUMENTATION:

Balance (5 decimal places), muffle furnace, filters, Petri dishes
Computer system with appropriate software

REPORTING:

Max. Significant Figures: 3	Current W value: 0.5	Current T value: 2.5	Full Scale: N/A

CONTROLS:

Calibration	2 S class weights, e.g. QCC & QCD (results in grams)
Drift	Balance is reset to zero after every 10 weighings.
Recovery	2 standards, e.g. R1 & R2
Method Blank	Filter washed with 500 mL distilled water

Solids, Suspended Ignited (3188)
(Ash and Loss on Ignition)
Quality Control Data from 2008/1/1 to 2008/12/31

Calibration Control

	Number	Expected	Mean	Mean Bias	Std. Dev.
C	5	0.50000	0.50000	0.00000	0.00001
D	5	0.05000	0.05000	0.00000	0.00000
C+D		0.55000	0.55000	0.00000	0.00001
C-D		0.45000	0.45000	0.00000	0.00001

Between Run VS Within Run Standard Deviations

s.d.(CD)	Between Runs	0.00007
	Within Runs	0.00005
	Between/Within	1.40000

Control Limits

Control Standard	Control Limits
C (0.5)	0.49998 - 0.50002
D (0.05)	0.04999 - 0.05001

Duplicates - Ash

Number	Concentration	Std. Dev.	% Coeff of Var
4	0 - 10	0.222	17.738

Duplicates - Loss of Ignition

Number	Concentration	Std. Dev.	% Coeff of Var
4	0 - 10	0.08	2.097

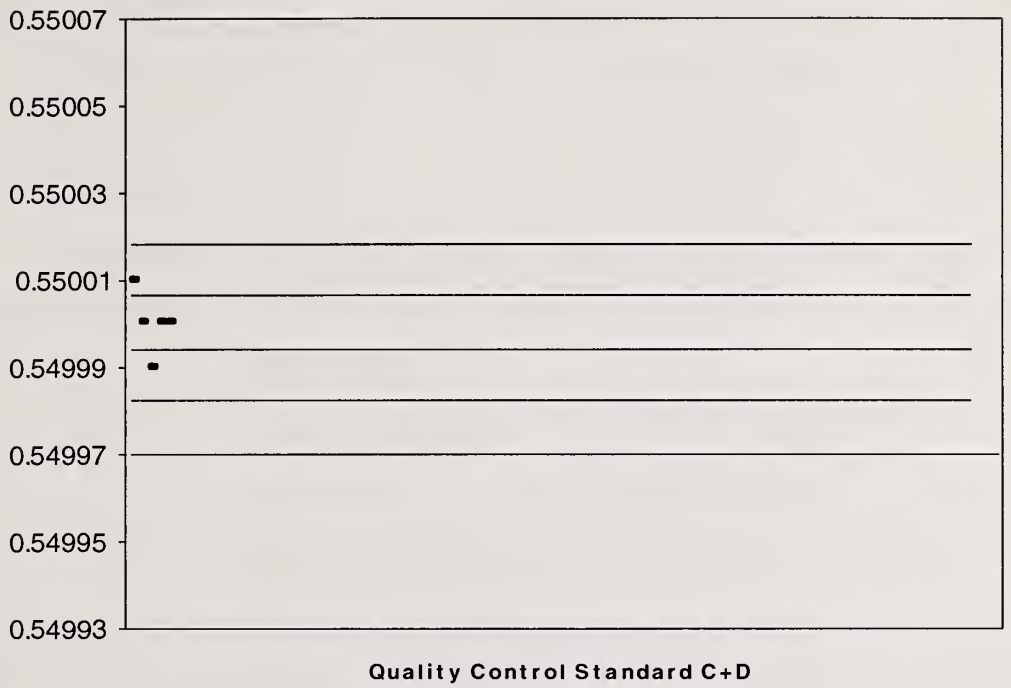
Recovery Standards

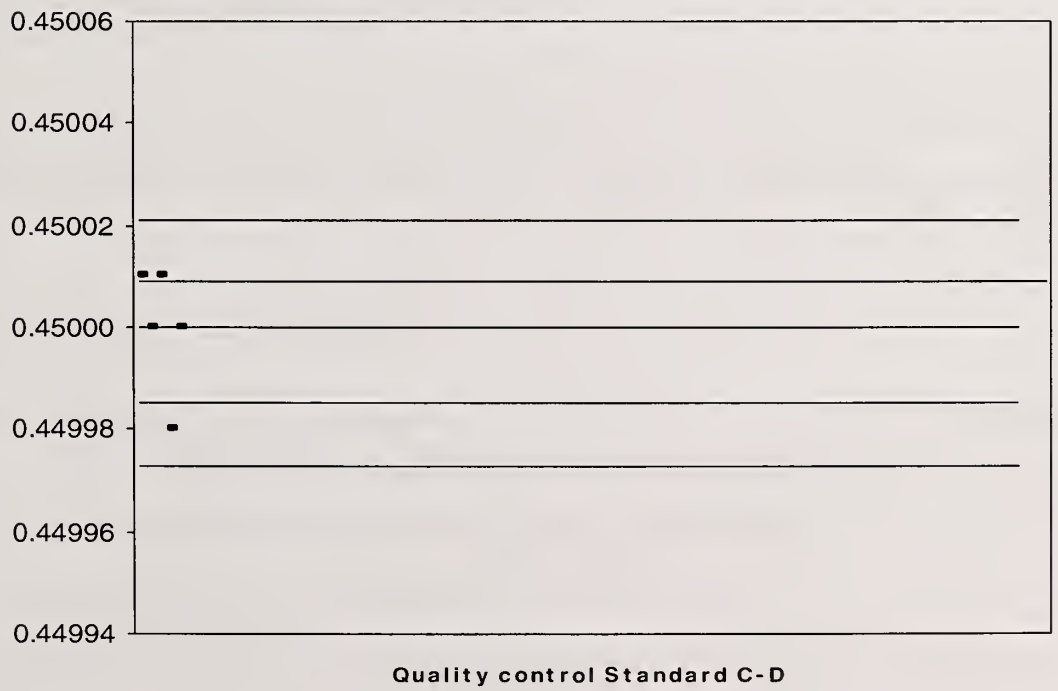
	Number	Expected	Mean	Mean Bias	Std. Dev.	Control Limits
Ash R1	5	200.000	170.038	-29.962	3.723	165.70 – 176.10
Ash R2	5	50.000	38.630	-11.370	8.663	39.30 – 44.60
LOI R1	5	0.000	24.206	24.206	0.963	19.94 – 28.64
LOI R2	5	0.000	6.656	6.656	0.308	5.42 – 8.22

Other Checks

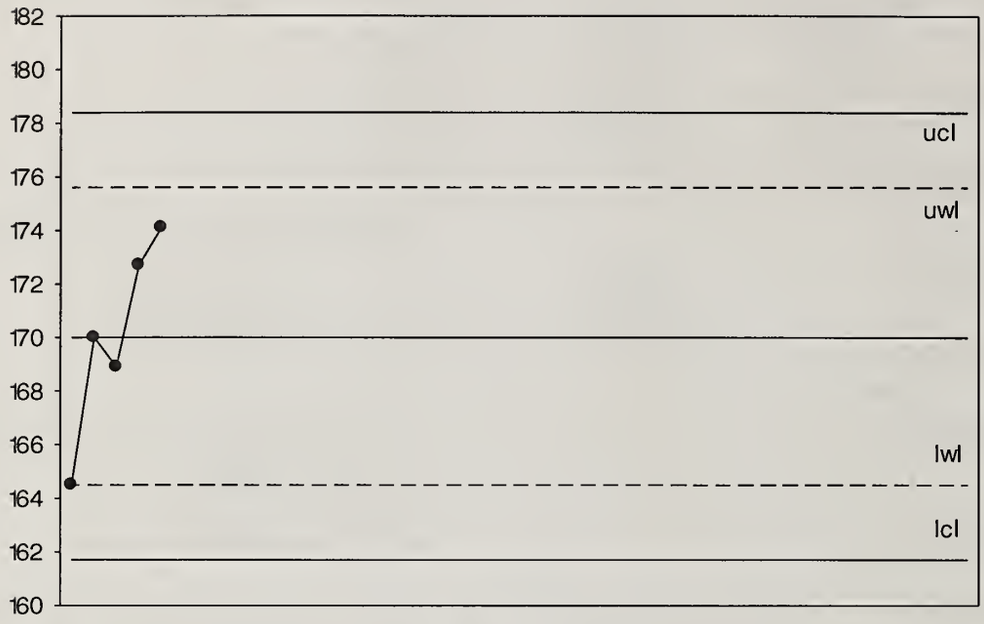
	Number	Expected	Mean	Mean Bias	Std. Dev.
Ash Blk	5	0.0000	0.0680	0.0680	0.0522
LOI Blk	5	0.0000	0.03200	0.0320	0.1154

Solids, Suspended Ignited (3188)
(Ash and Loss on Ignition)
Quality Control Data from 2008/1/1 to 2008/12/31

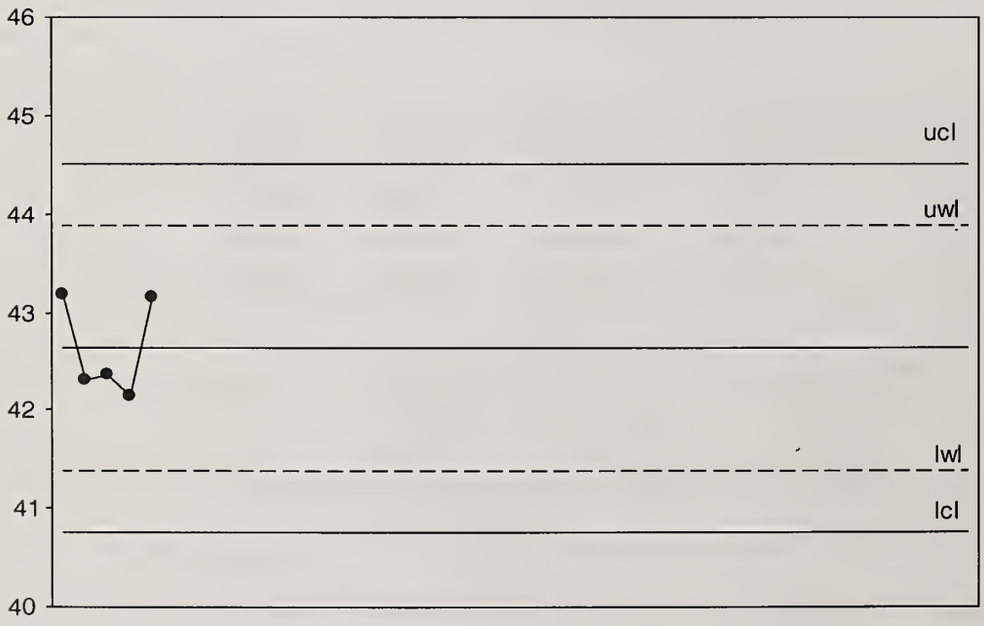




Solids, Suspended Ignited (3188)
(Ash and Loss on Ignition)
Quality Control Data from 2008/1/1 to 2008/12/31



Recovery Std 1



Recovery Std 2

SOLIDS, TOTAL

ACCREDITATION & DRINKING-WATER LICENSING STATUS

ACCREDITED ☑	Licensed (Drinking Water) ☑
	Drinking Water Standard (SDWA): N/A

IDENTIFICATION:

aboratory	Water Chemistry	Method Introduced	Before '81
Method Reference No.	E3188	Reporting Unit	mg/L or mg/Kg
IMS Product Code	TS3188	Supervisor	P. Wilson
ample Type/Matrix	Sludge, Effluent, Raw Sewage, Industrial Waste, Process Water, Surface Water, Drinking Water, Ground Water, Leachate		

SAMPLING:

Quantity Required	125 mL – 250 mL
Container	Glass or plastic
Preservative(s)	None

ANALYTICAL PROCEDURE: Generally, 100 mL aliquot of sample (alternate 50 mL) is pipetted into a preweighed Teflon dish, dried at 103-105^{0}C, and stored in a desiccator for at least 24 hours. The total residue or solids content is alculated by subtracting the original dish mass from the dried dish mass. Data collection, calculations, and transfer of results to LIMS are controlled by a computer system.

INSTRUMENTATION:

Balance (4 decimal places), drying oven, dishes (Teflon).
Computer system with appropriate software.

REPORTING:

Max. Significant Figures: 3	Current W value: 10.0	Current T value: 50.0	Full Scale: N/A

CALIBRATION:

Balance zero
Balance internal calibration performed daily.

CONTROLS:

Calibration	2 S class weights, e.g. QCA & QCB (results in grams)
Drift	Balance is reset to zero after every 10 weighings.
Recovery	2 standards, e.g. R1 & R2
Blank	

Solids, Total (3188)
Quality Control Data
2008/1/1 to 2008/12/31

Calibration Control

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	6	50.0000	50.00000	0.00000	0.00009
B	6	30.0000	30.00002	0.00002	0.00004
A + B		80.0000	80.00002	0.00002	0.00012
A - B		20.0000	19.99998	-0.00002	0.00008

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.00007
	Within Runs	0.00005
	Between/Within	1.40000

Control Limits

Control Standard	Control Limits
A (50)	49.9998 – 50.0002
B (30)	29.9998 – 30.0002

Duplicates

Number	Concentration	Std. Dev.	% Coeff of Var
5	0.0 - 20000	105.144	0.712
5	20001-40,000	159.891	0.571

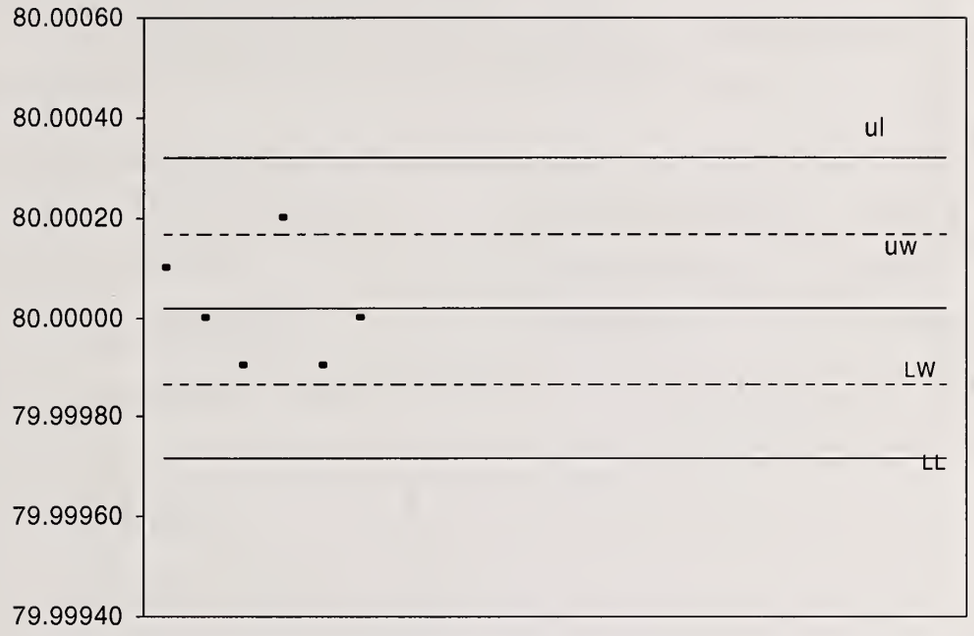
Check Standards

	Number	Expected	Mean	Mean Bias	Std. Dev.	Control Limits
R1 (KCl)	6	20000.000	19898.577	-101.423	278.037	19584.3 – 20415.7
R2 (KCl)	6	2000.000	2001.553	1.553	9.377	1944.82 – 2019.18

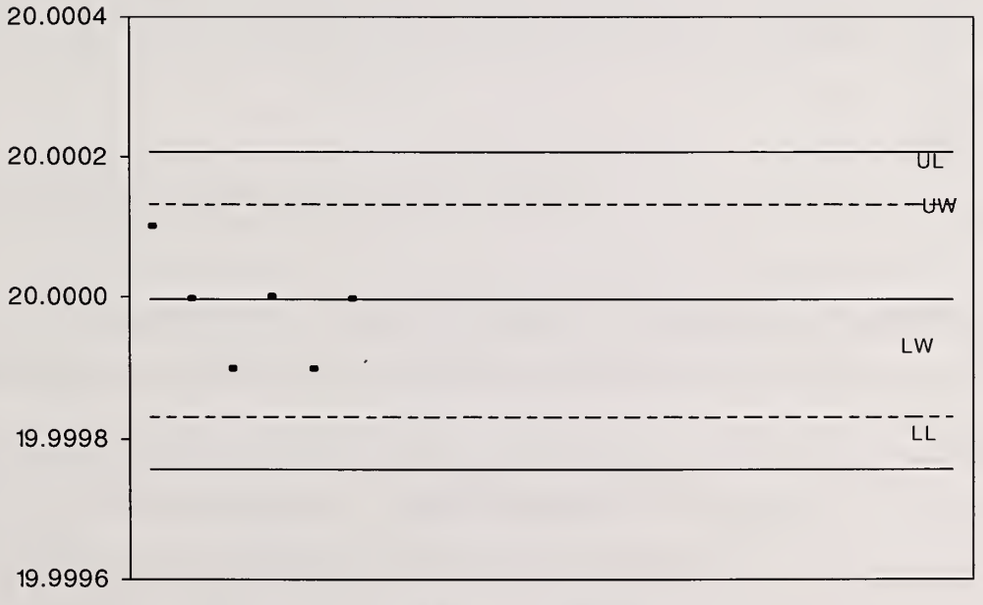
Other Checks

	Number	Expected	Mean	Mean Bias	Std. Dev.
LTB	6	0.00000	-0.20333	-0.20333	2.05154

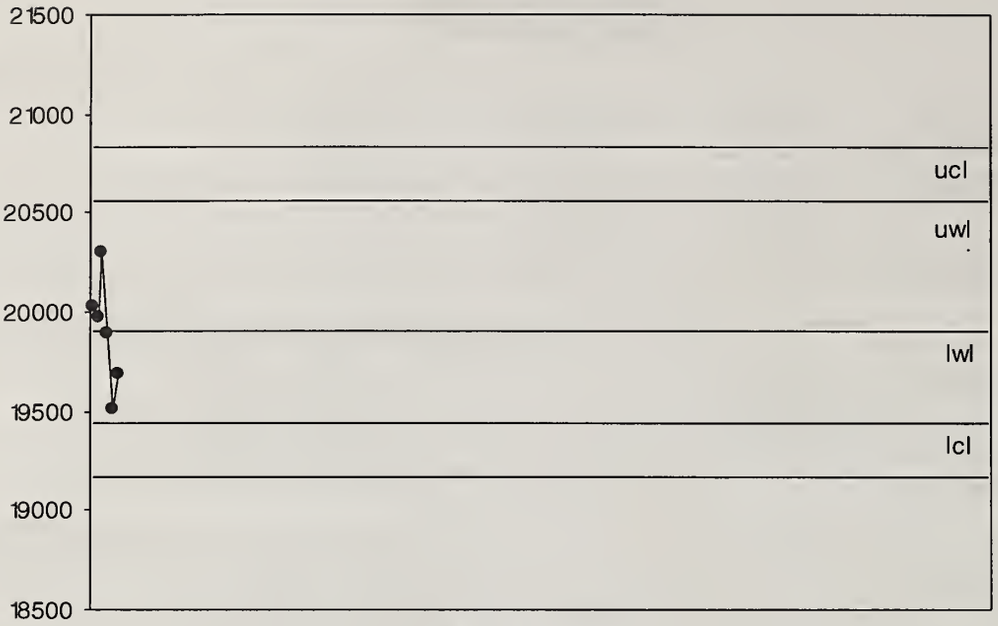
Solids, Total (3188)
Quality Control Data
2008/1/1 to 2008/12/31



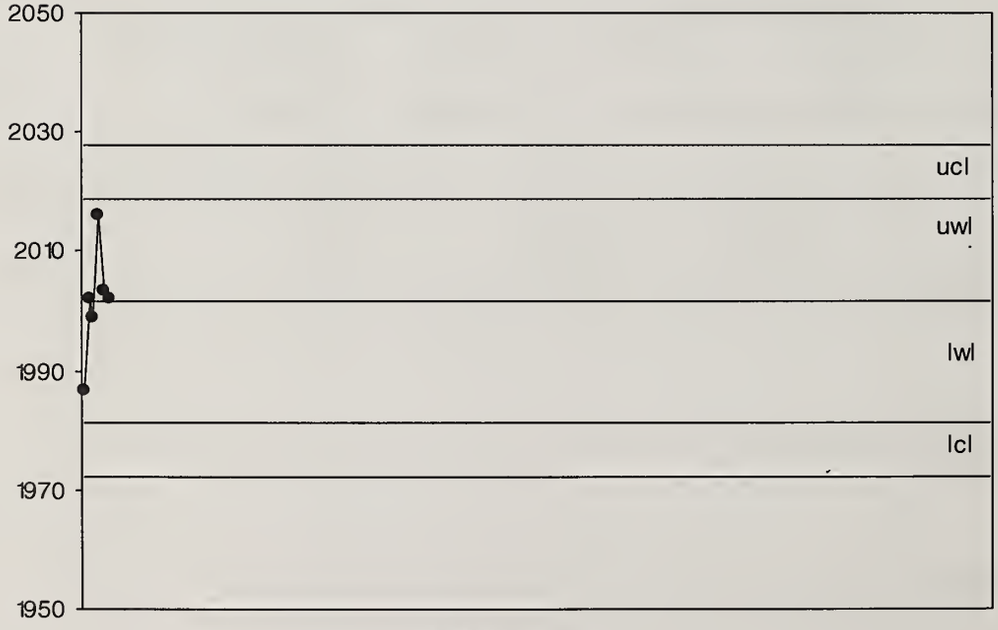
Quality Control Standard A + B



Quality Control standard A- B



Recovery Std 1



Recovery Std 2

SOLIDS, TOTAL IGNITED
(Ash and Loss On Ignition)

ACCREDITATION & DRINKING-WATER LICENSING STATUS

ACCREDITED ☑	Licensed (Drinking Water) N/A
	Drinking Water Standard (SDWA): N/A

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	Before '61
Method Reference No.	E3188	Reporting Unit	mg/L
LIMS Product Code	TIGN3188	Supervisor	P. Wilson
Sample Type/Matrix	Sludge, Effluent, Raw Sewage, Industrial Waste, Process Water		

SAMPLING:

Quantity Required	5-500 mL
Container	Glass or plastic
Preservative(s)	None

ANALYTICAL PROCEDURE:

The procedure for total solids (TS3188) is followed and the dried residue is ignited at 600±50^{0}C for one hour in a muffle furnace. The dish is transferred to a desiccator to cool. The ash (fixed solids) is the difference between the final ignited mass dish and the original tare weight of the dish, divided by the original sample volume (mL) used for TS3188. The loss on ignition (estimate of volatile total solids) is the difference between the final ignited mass plus dish and the residue (total solids) plus dish, divided by the original sample volume (mL). Data collection, calculations, and transfer of results to LIMS are controlled by a computer system.

INSTRUMENTATION:

Balance (4 decimal places), muffle furnace, filters, ceramic dishes.
Computer system with appropriate software.

REPORTING:

Max. Significant Figures: 3	Current W value: 10.0	Current T value: 50.0	Full Scale: N/A

CONTROLS:

Calibration	2 S class weights, e.g. QCA & QCB (results in grams)
Drift	Balance is reset to zero after every 10 weighings.
Recovery	2 stds. eg. R1
Blank	

Solids, Total Ignited (3188)
(Ash and Loss on Ignition)
Quality Control Data from 2008/1/1 to 2008/12/31

Calibration Control

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	17	50.0000	50.00002	0.00002	0.00006
B	17	30.0000	30.00005	0.00005	0.00007
A + B		80.0000	80.00006	0.00006	0.00012
A - B		20.0000	19.99997	-0.00003	0.00007

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.00007
	Within Runs	0.00005
	Between/Within	1.40000

Control Limits

Control Standard	Control Limits
A (50)	49.9998 – 20.0002
B (30)	29.9998 – 30.0002

Duplicates – Dry

Number	Concentration	Std. Dev.	% Coeff of Var
5	0 - 1000	6.663	0.899
33	1001 - 5000	18.520	0.834
14	5001 – 30000	685.604	6.419

Duplicates – Ash

Number	Concentration	Std. Dev.	% Coeff of Var
3	0 - 500	2.449	0.618
3	501 – 1000	15.895	2.104
32	1001 – 2000	40.030	2.863
11	2001 – 10000	28.236	0.985

Duplicates – Loss of Ignition

Number	Concentration	Std. Dev.	% Coeff of Var
5	0 - 1000	6.663	0.899
39	1001 – 5000	18.520	0.834
5	5001 – 10000	685.604	6.419

Solids, Total Ignited conc.

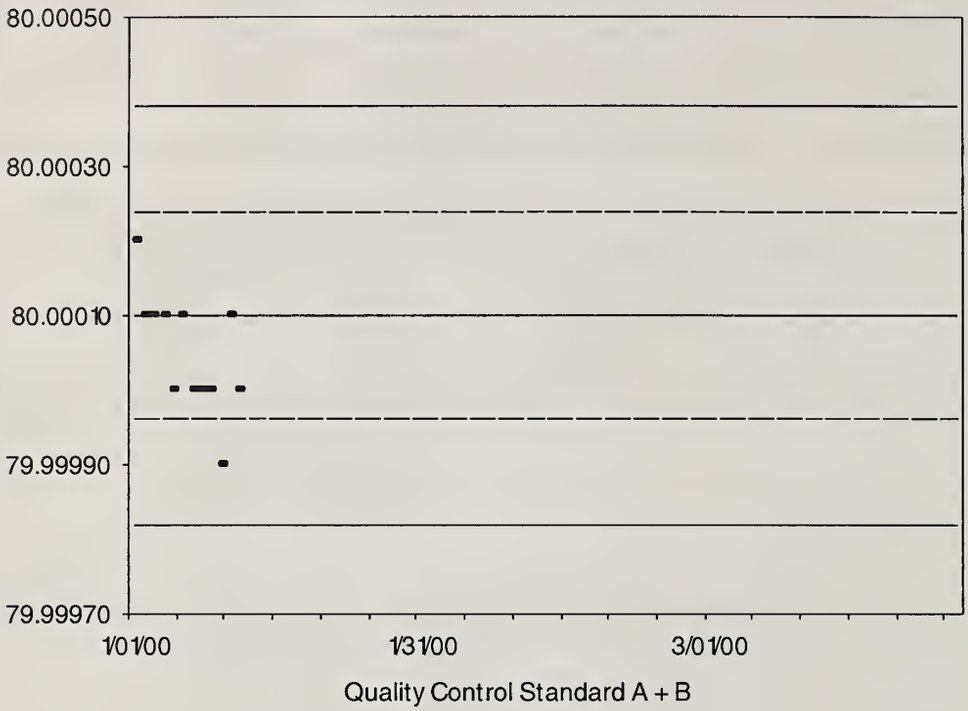
Recovery Standards

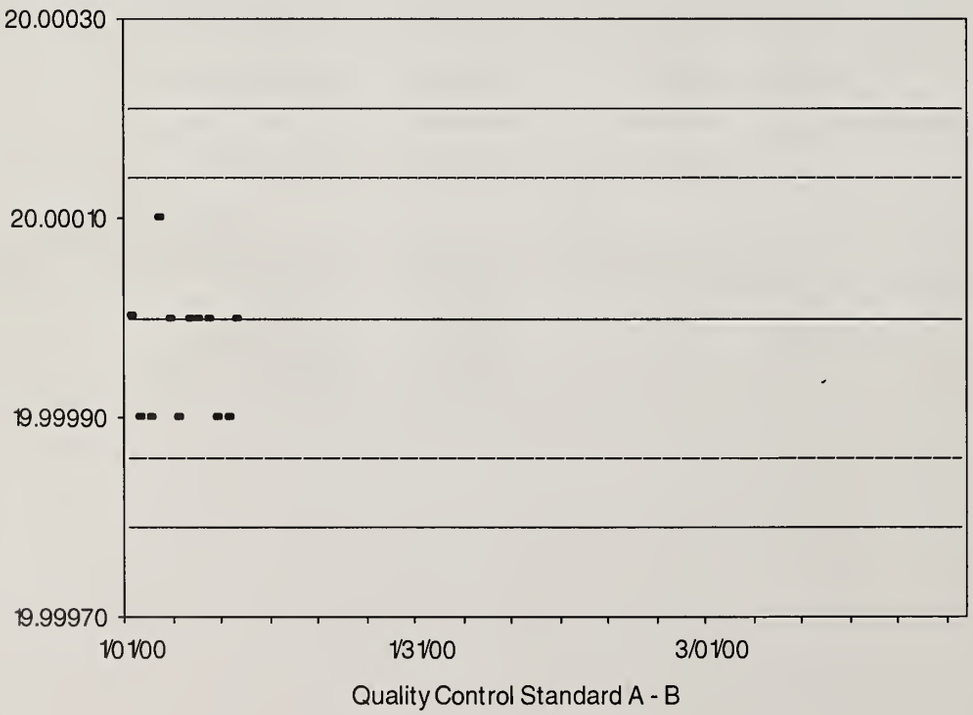
	Number	Expected	Mean	Mean Bias	Std. Dev.	Control Limits
Dry R1	17	2000.000	1983.647	-16.353	102.324	19693.04 – 20306.96
Dry R2	17	200.000	198.706	-1.294	13.894	1958.33 – 2041.67
Ash R1	17	2000.000	1756.176	-243.824	109.610	19671.17 – 20328.83
Ash R2	17	200.000	173.529	-26.471	15.933	1952.21 – 2047.79
LOI R1	17		243.529	243.529	17.486	± 157.2
LOI R2	17		25.176	25.176	4.419	± 44.28

Other Checks

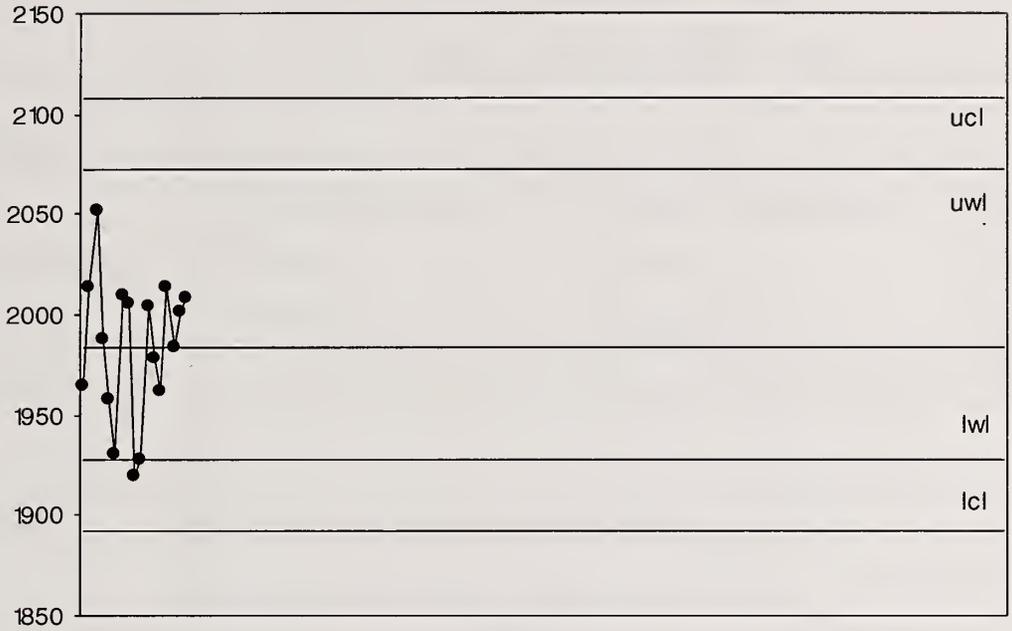
	Number	Expected	Mean	Mean Bias	Std. Dev.
Dry Blk	17	0.000	1.529	1.529	4.611
Ash Blk	17	0.000	2.706	2.706	2.823
LOI Blk	17	0.000	-0.941	-0.941	4.250

Solids, Total Ignited (3188)
(Ash and Loss on Ignition)
Quality Control Data from 2008/1/1 to 2008/12/31

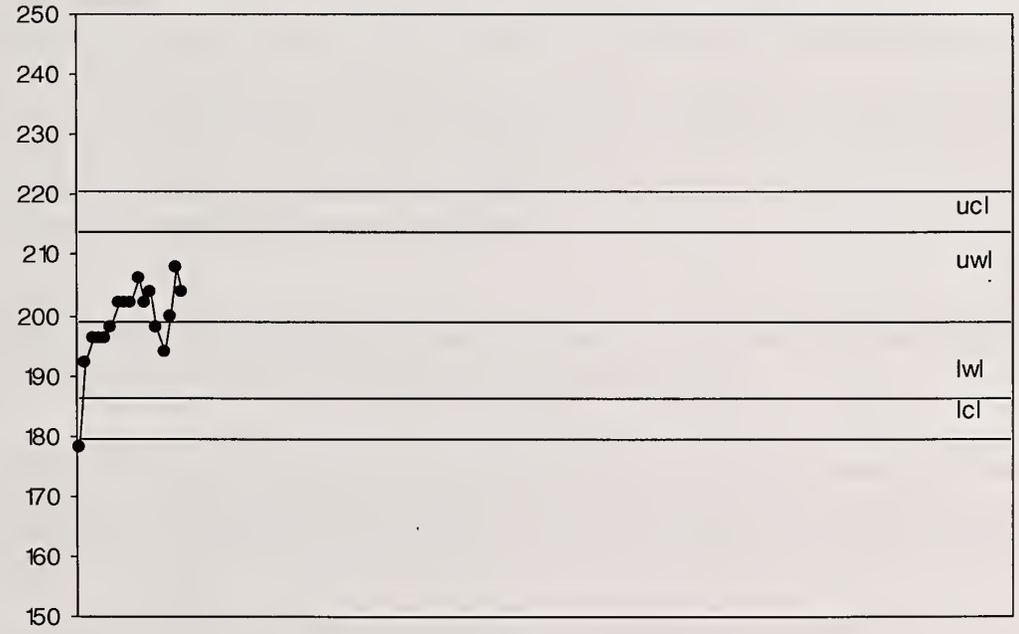




Solids, Total Ignited (3188)
(Ash and Loss on Ignition)
Quality Control Data from 2008/1/1 to 2008/12/31

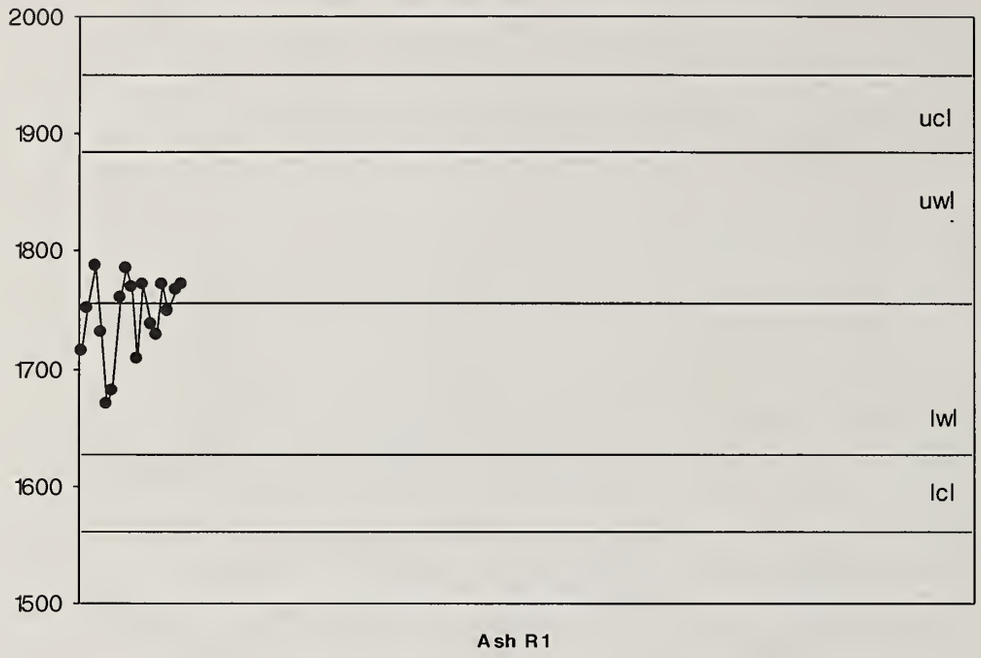


Dry R1

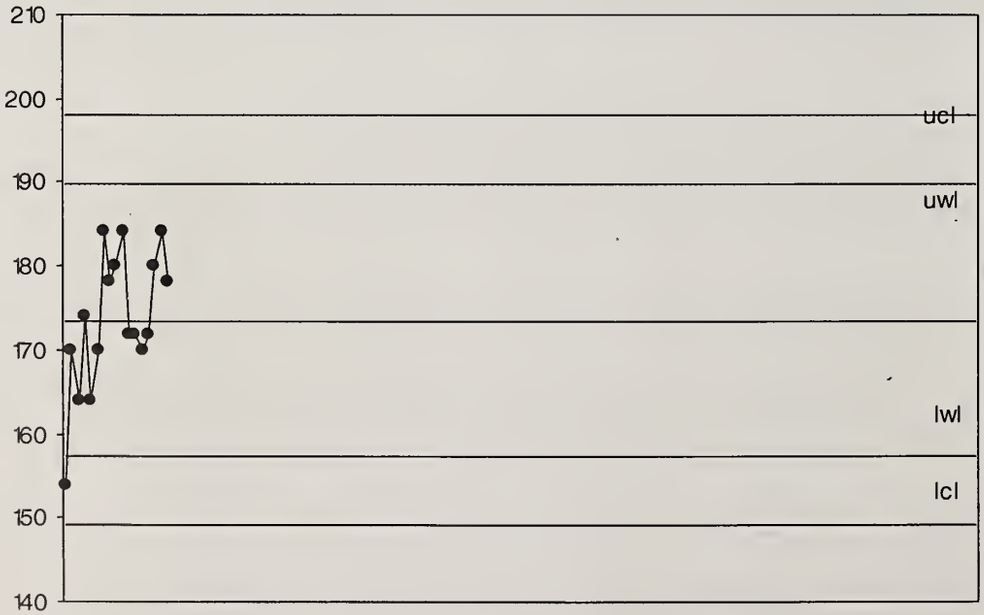


Dry R2

Solids, Total Ignited (3188)
(Ash and Loss on Ignition)
Quality Control Data from 2008/1/1 to 2008/12/31



Ash R1



Ash R2

SULPHATE

ACCREDITATION & DRINKING-WATER LICENSING STATUS

ACCREDITED ☑	Licensed (Drinking Water) N/A
	Drinking Water Standard (SDWA): N/A

IDENTIFICATION:

Laboratory Unit	Water Chemistry	Method Introduced	01/04/78
Method Reference No.	E3004	Units	$\mu g/m^3$ as SO_4
LIMS Product Code	ANION3004	Supervisor	P. Wilson
Sample Type/Matrix	Air; HiVol Glass Fibre, Quartz and Polyflon, Other Filters and Puff		

SAMPLING:

Quantity Required	3/4" or 1.9cm strip from 8"x10" filter
Container	50 mL polypropylene tube
Preservative(s)	None

SAMPLING PREPARATION:

A 3/4" strip is cut in pieces and deposited into a 50 mL polypropylene tube. 50 mL of Pure-Water is added to the tube. The tube is placed on a horizontal shaker for approximately 1 hour. The supernatant is then filtered into a 15 mL plastic tube and analysed.

ANALYTICAL PROCEDURE:

Sulphate separated from other anions in the sample by automated suppressed ion chromatography using an eluent mixture of sodium bicarbonate and sodium carbonate and a conductivity detector. The concentration of sulphate (mg/L) is determined by the comparison of the analyte peak area count to that of a series of standards. The analyte result is corrected for the filter blank before the final calculation is made. The result is reported as $\mu g/m^3$ as SO_4.
Chloride and nitrate are determined simultaneously.

INSTRUMENTATION:

Horizontal Shaker, ion chromatographic system plus a PC with ChromPerfect software and DT2804 card for automated sample injection, timing, and data processing.

REPORTING:

Max. Significant Figures: 3	Current W value: 0.1 $\mu g/m^3$	Current T value: 0.5 $\mu g/m^3$	Full Scale: 100 mg/L

CALIBRATION:

9 standards

SULPHATE cont'd

CONTROLS:

Calibration	MB, QCA and QCB
Drift	2 standards every 20 samples
Recovery	CS4 & CS5

NOTES:

To convert unit from mg/L to $\mu g/m^3$, the final concentration of SO_4 in $\mu g/m^3$ is calculated by the following formula:

Result (mg/L) X 50mL X (63/6.75) / air volume = $\mu g/m^3$

Where: 63 is the area of the filter exposed and 6.75 is the sample aliquot area in square inches.

Sulphate SO_4^{-2} (E3004)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 28.6 µg/m^3 (100.00 mg/L) as SO_4^{-2}

Calibration Control

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	6	80.00	80.004	0.004	0.537
B	6	20.00	19.881	-0.119	0.257
A + B		100.00	99.885	-0.115	0.423
A - B		60.00	60.260	0.260	0.728

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.421
	Within Runs	0.514
	Between/Within	0.819

Control Limits

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	101.330	98.670	102.650	97.350
A - B	61.330	58.670	61.990	58.010

Duplicates: (µg/m3)

Number	Concentration	Std. Dev.	% Coeff of Var
5	0.0-2.86	0.011	0.659
6	2.89-7.15	0.071	1.646
3	7.18-14.31	0.035	0.313
4	14.33-28.61	0.125	0.570

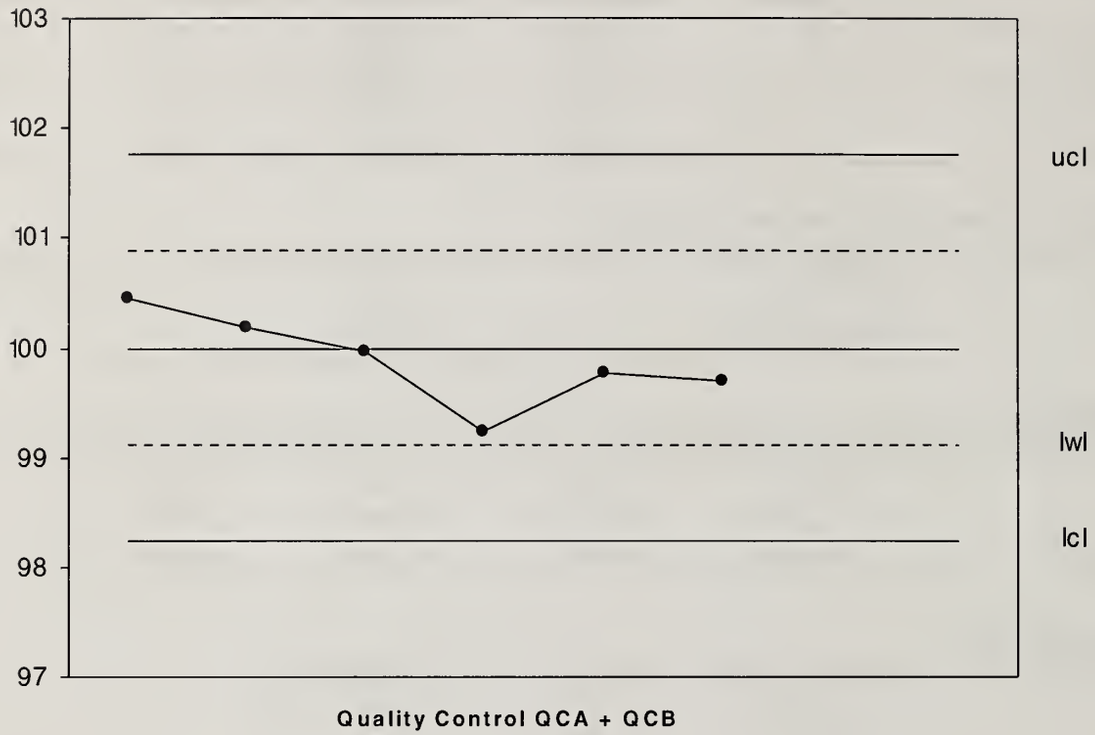
Check Standards: (µg/m3)

	Number	Expected	Mean	Mean Bias	Std. Dev.
CS1	6	9.000	9.015	0.015	0.091
CS2	6	90.000	89.872	-0.128	0.666
CS4	6	40.300	38.628	-1.672	1.665
CS5	6	34.630	34.838	0.158	0.684

Control Limits: (µg/m3)

Check Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
CS1	9.310	8.690	9.460	8.540
CS2	91.200	88.800	91.800	88.200
CS4	42.580	38.020	43.720	36.880
CS5	36.200	33.060	36.960	32.300

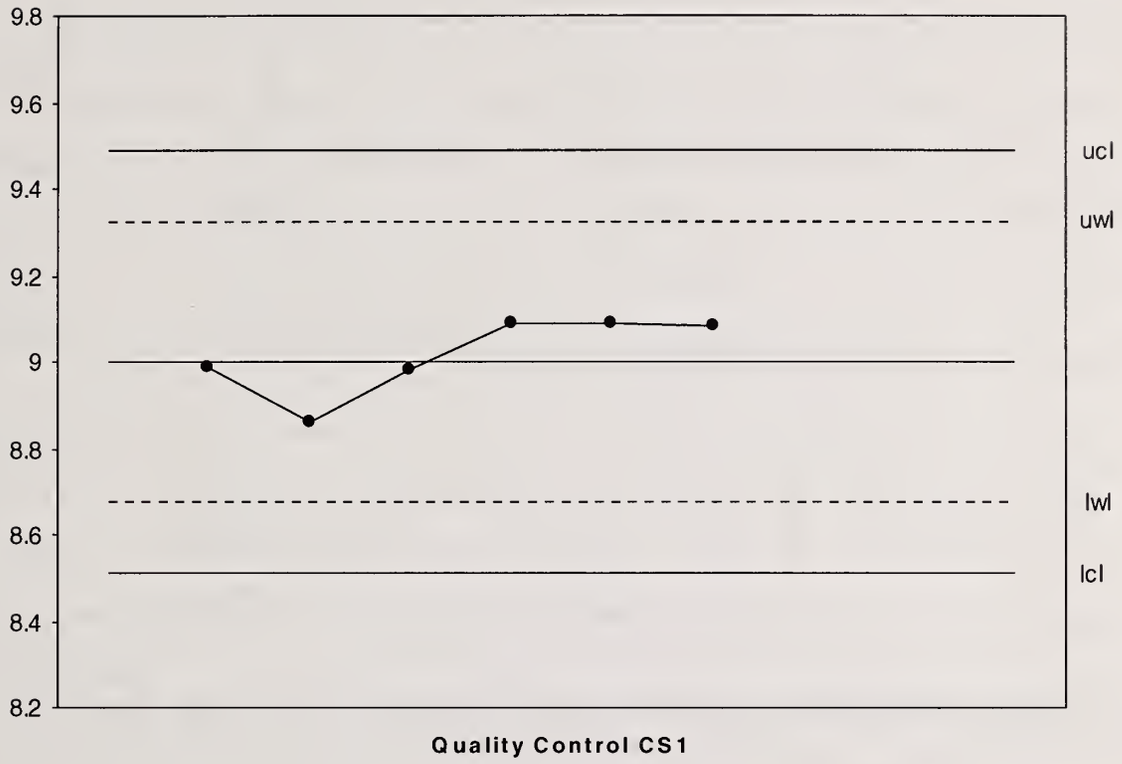
Sulphate SO_4^{-2} (E3004)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 28.6 µg/m^3 (100.00 mg/L) as SO_4^{-2}



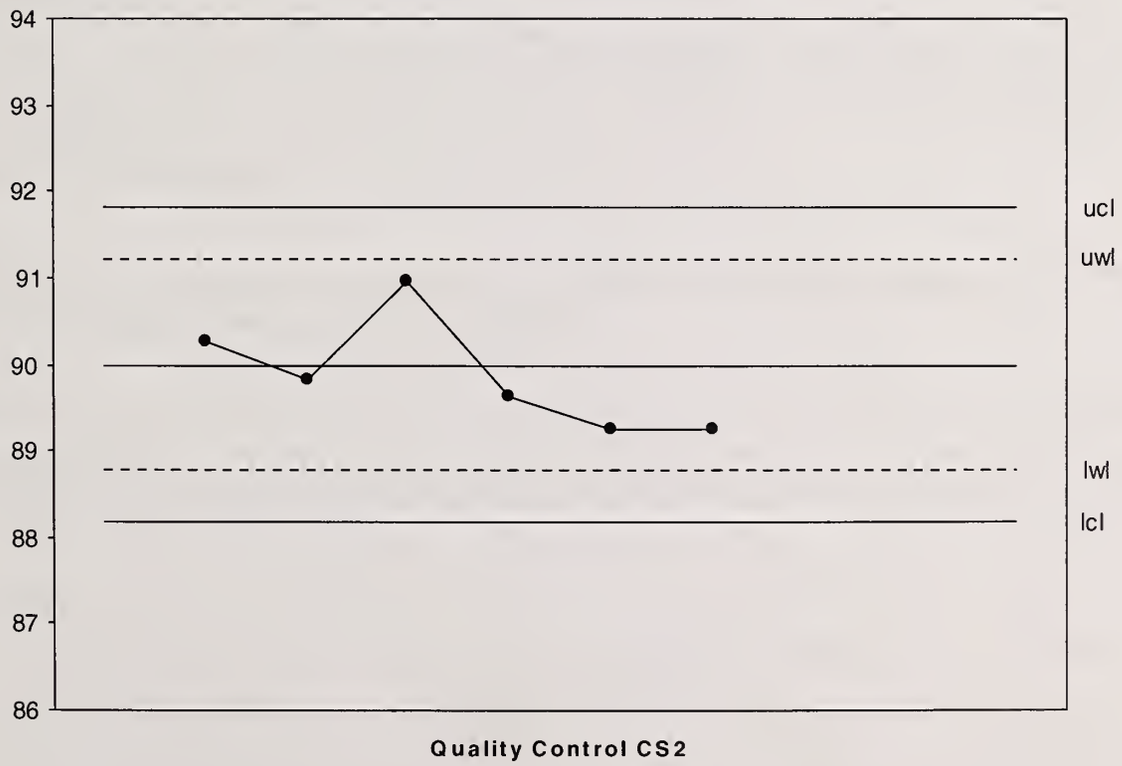
Quality Control QCA + QCB

Quality Control QCA - QCB

Sulphate SO_4^{-2} (E3004)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 28.6 µg/m^3 (100.00 mg/L) as SO_4^{-2}



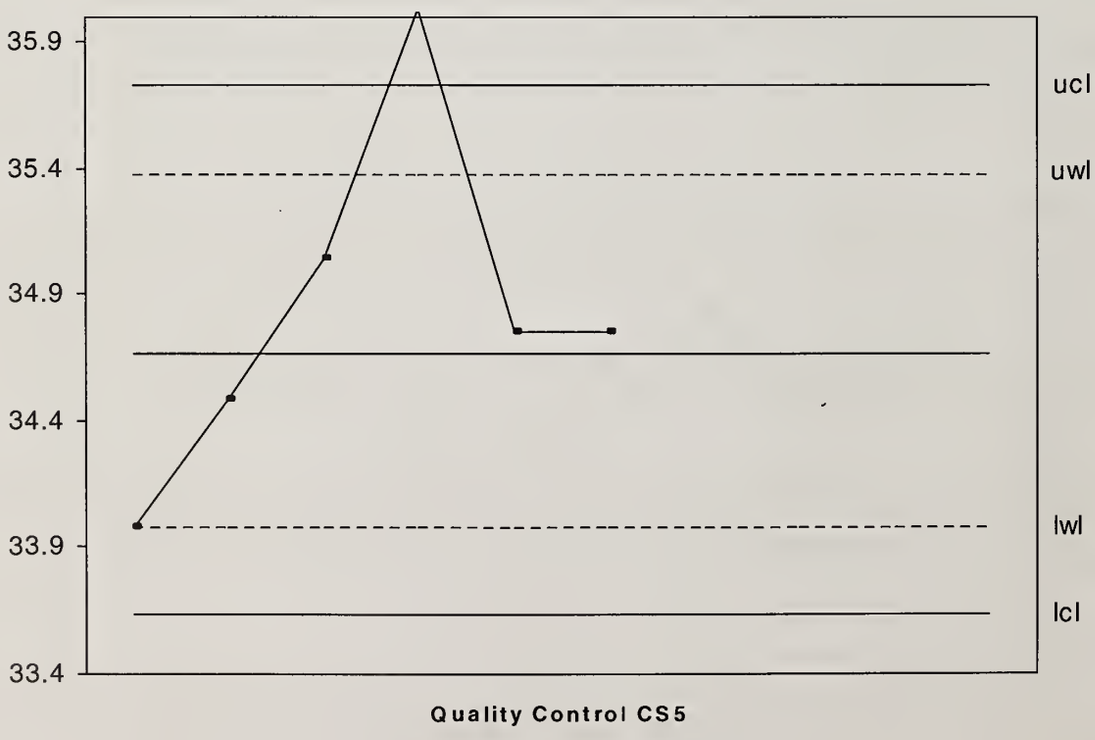
Quality Control CS1



Quality Control CS2

Sulphate SO_4^{-2} (E3004)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 28.6 µg/m^3 (100.00 mg/L) as SO_4^{-2}

Quality Control CS4



Quality Control CS5

SULPHATE

CREDITATION & DRINKING-WATER LICENSING STATUS

ACCREDITED ☑	Licensed (Drinking Water) N/A
	Drinking Water Standard (SDWA): N/A

ENTIFICATION:

Laboratory Unit	Water Chemistry	Method Introduced	31412
Method Reference No.	E3013	Units	µg/g as SO_4
LIMS Product Code	ANION3013, SUL3013	Supervisor	P. Wilson
Sample Type/Matrix	Soil and Sediment		

AMPLING:

Quantity Required	20 g
Container	glass or plastic
Preservative(s)	None

AMPLING PREPARATION:

A 3.0 g sample of air dried, sieved soil or air dried sieved and ground sediment is placed in a 50 mL centrifuge tube and shaken with 30 mL Pure-DW for 1 hour on a shaker. Samples are centrifuged, membrane filtered and analyzed for chloride and sulphate by ion chromatography.

NALYTICAL PROCEDURE:

Sulphate is separated from other anions in the sample by automated suppressed ion chromatography using an eluent mixture of sodium bicarbonate and sodium carbonate and a conductivity detector. The concentration of sulphate (mg/L) is determined by the comparison of the analyte peak area count to those of a series of standards. The result is reported as µg/g as SO_4.
Chloride is determined simultaneously.

STRUMENTATION:

Horizontal Shaker, ion chromatographic system plus a PC with ChromPerfect software and DT2804 card for automated sample injection, timing, and data processing.

EPORTING:

Max. Significant Figures: 3	Current W value: 0.5 µg/g	Current T value: 2.5 µg/g	Full Scale: 100 mg/L

ALIBRATION:

9 standards

SULPHATE cont'd

CONTROLS:

Calibration	MB, QCA and QCB
Recovery	R21, SO201, SO202, R23, R16
Drift	2 standards every 20 samples

Sulphate SO_4^{-2} (E3013)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 100.00 mg/L as SO_4^{-2}

Calibration Control

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	4	80.00	79.595	-0.405	0.818
B	4	20.00	20.000	0.000	0.497
A + B		100.00	99.595	-0.405	1.106
A - B		60.00	59.595	-0.405	0.781

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.677
	Within Runs	0.552
	Between/Within	1.226

Control Limits

Control Standard	Warning Limits		Control Limits	
	Lower	Upper	Lower	Upper
A + B	98.550	101.450	97.100	102.90
A - B	58.550	61.450	57.820	62.18

Duplicates: (µg/L)

Number	Concentration	Std. Dev.	% Coeff of Var
7	0 - 200	1.252	2.096
1	201 - 500	1.273	0.289
4	501 - 1000	213.388	1.564

Recoveries: (µg/L)

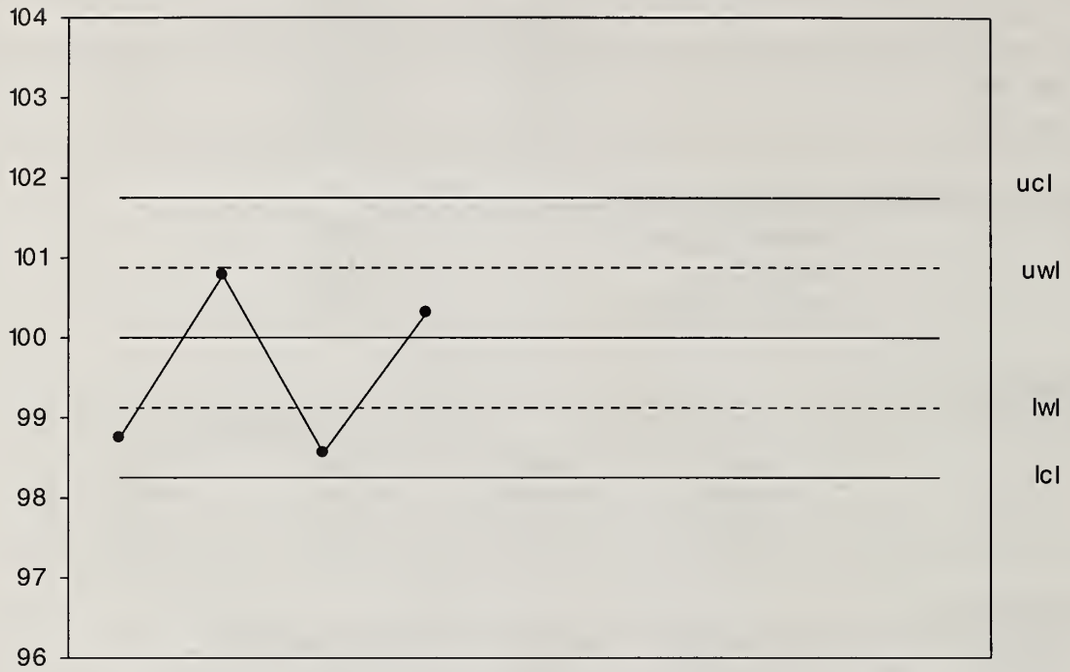
	Number	Expected	Mean	Mean Bias	Std. Dev.
SO201	4	73.200	86.338	13.138	9.253
SO202	4	445.400	445.705	0.305	70.267
R21	4	44.600	48.945	4.345	4.904
R16	4	46.400	69.283	22.883	20.667
R23	4	5400.000	6079.500	679.500	536.245

Control Limits: (µg/L)

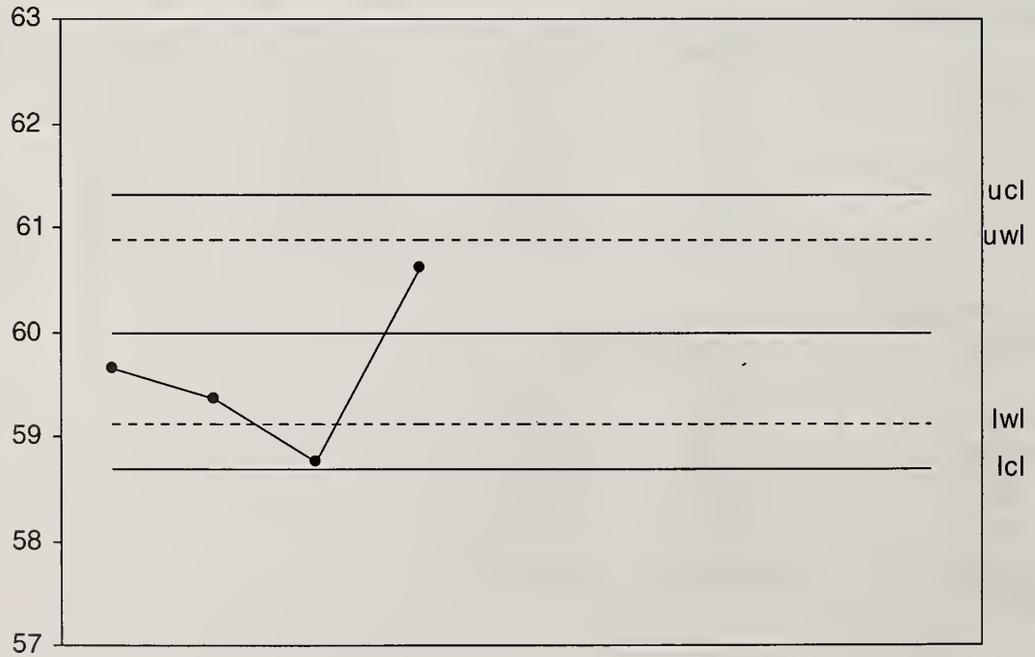
Check Standard	Control Limits	
	Lower	Upper
SO201	40.300	106.100
SO202	245.000	645.800
R21	24.500	64.700
R16	25.500	67.300
R23*	4680.000	6119.000

*Tentative

Sulphate SO_4^{-2} (E3013)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 100.00 mg/L as SO_4^{-2}

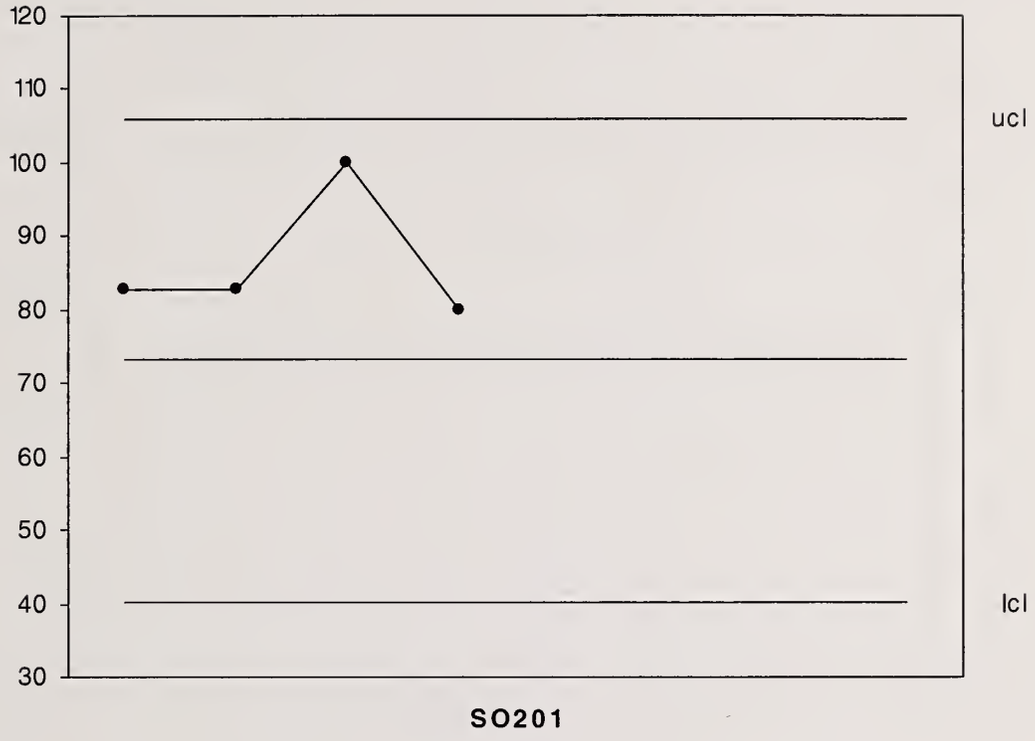


Quality Control A + B

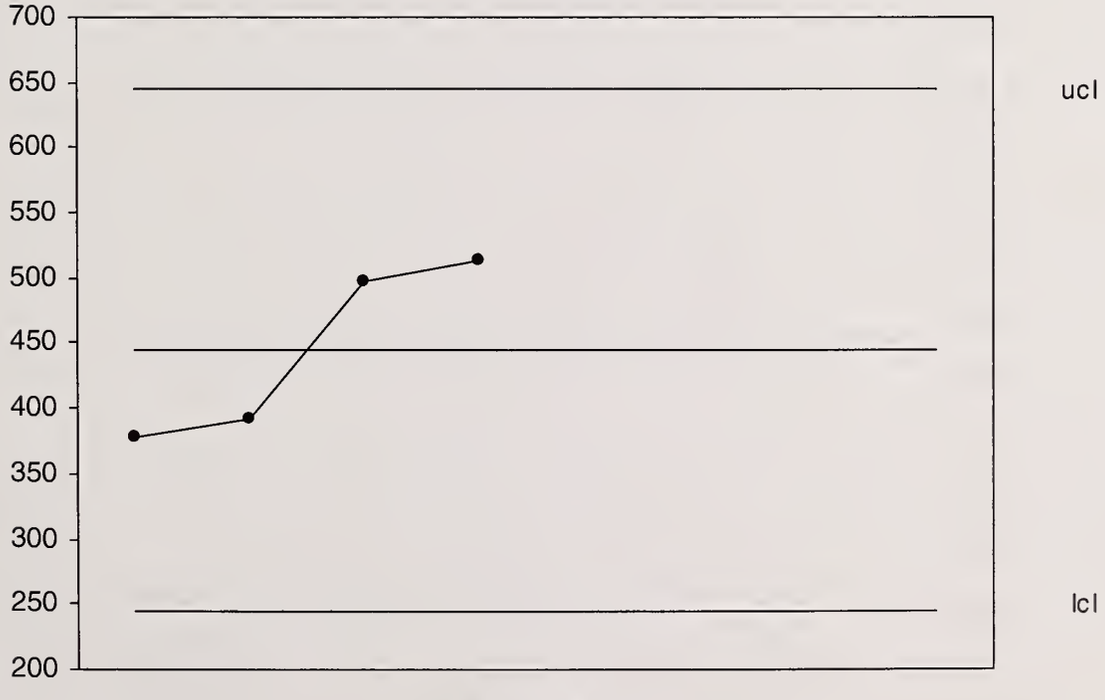


Quality Control A - B

Sulphate SO_4^{-2} (E3013)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 100.00 mg/L as SO_4^{-2}

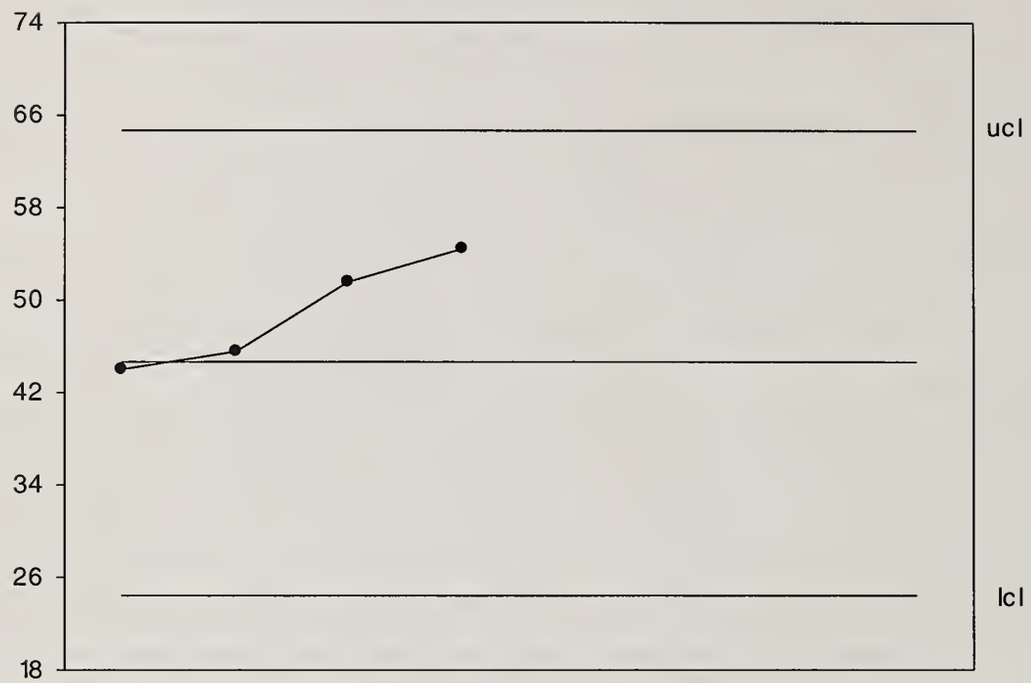


SO201

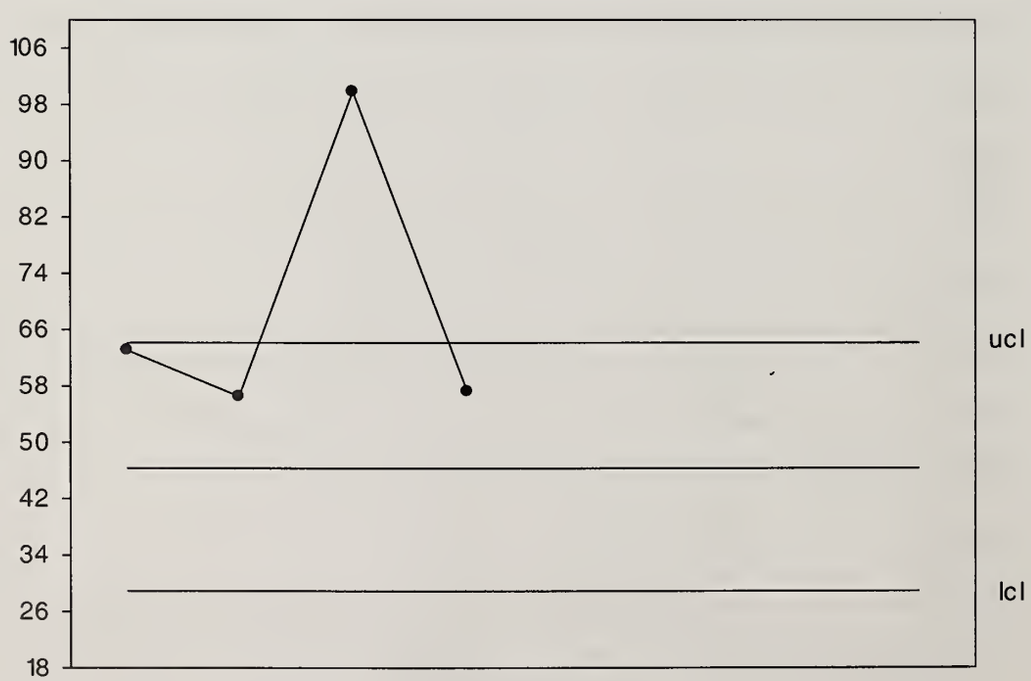


SO202

Sulphate SO_4^{-2} (E3013)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 100.00 mg/L as SO_4^{-2}

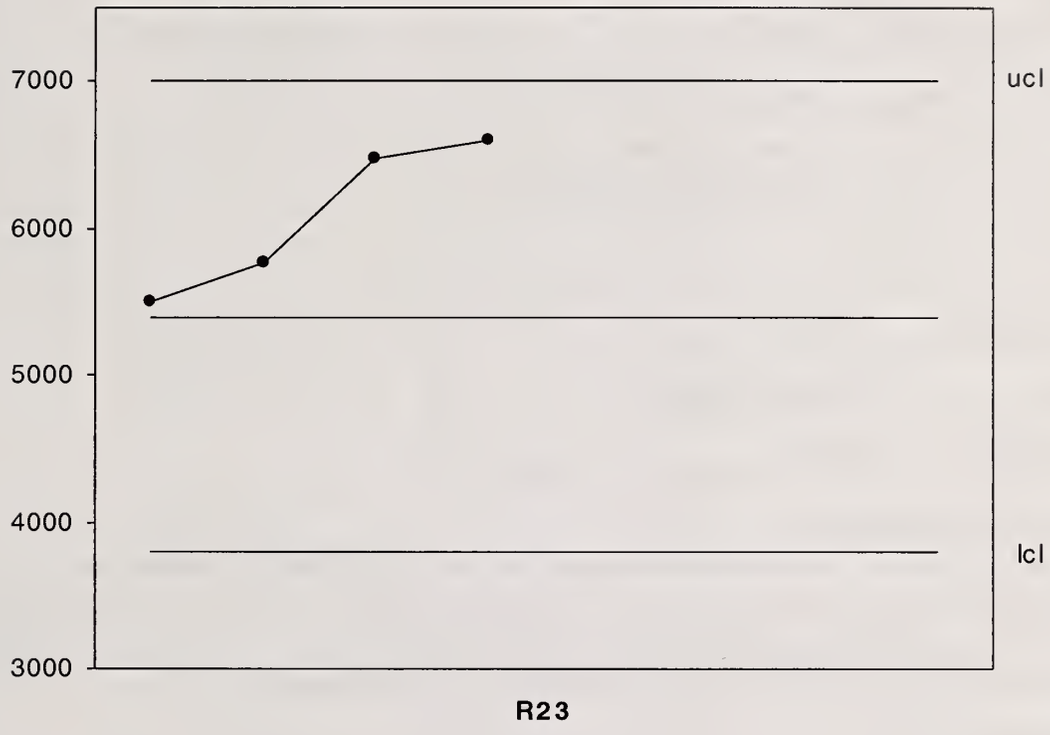


R21



R16

Sulphate SO_4^{-2} (E3013)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 100.00 mg/L as SO_4^{-2}



SULPHATE

ACCREDITATION & DRINKING-WATER LICENSING STATUS

ACCREDITED ☑	Licensed (Drinking Water) ☑
	Drinking Water Standard (SDWA): N/A

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	29954
Method Reference No.	E3172	Reporting Unit	mg/L as SO_4
LIMS Product Code	SULP3172, Anion3172	Supervisor	P.Wilson
Sample Type/Matrix	Drinking Water, Surface Water, Ground Water, Leachates, Effluent, Industrial Waste, Raw Sewage		

SAMPLING:

Quantity Required	50 mL
Container	Glass or plastic
Preservative(s)	None

ANALYTICAL PROCEDURE:

Sulphate is separated from other anions in the samples by automated suppressed ion chromatography using an eluent mixture of 0.001 M sodium bicarbonate and 0.0035 M sodium carbonate with conductivity detection. The concentration of sulphate in mg/L as SO_4 is determined by comparison of the sample scan to a series of standard scans.

INSTRUMENTATION:

Basic modular continuous flow ion chromatographic system consisting of a Chromeleon Chromatography Management System, Autosampler with Chromatography Compartment, Pump, Conductivity Detector, Eluent Suppression Systems using an Anion Self Regenerating Suppressor, and the Guard and Separator Columns).

REPORTING:

Max. Significant Figures: 3	Current W value: 0.5	Current T value: 2.5	Full Scale: 100.0 mg/L

CALIBRATION:

BL plus 9 standards

CONTROLS:

Calibration	LTBL plus 3 standards, e.g. QCA, QCB, QCC
Drift	CHK1 and CHK2 standard approximately every 20 samples

Sulphate SO_4^{-2} (E3172)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 100.00 mg/L as SO_4^{-2}

Calibration Control

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	82	80.00	80.127	0.127	0.249
B	82	40.00	39.962	-0.038	0.236
C	82	8.00	7.921	0.079	0.098
A + B		120.00	120.089	0.089	0.416
A - B		40.00	40.165	0.165	0.248
B + C		48.00	47.883	-0.117	0.309
B - C		32.00	32.041	0.041	0.186

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.244
	Within Runs	0.176
	Between/Within	1.386
s.d.(BC)	Between Runs	0.182
	Within Runs	0.132
	Between/Within	1.379

Control Limits

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	120.83	119.170	121.650	118.350
A - B	40.830	39.170	41.240	38.760
B + C	48.520	47.480	49.050	46.950
B - C	32.520	31.480	32.790	31.210

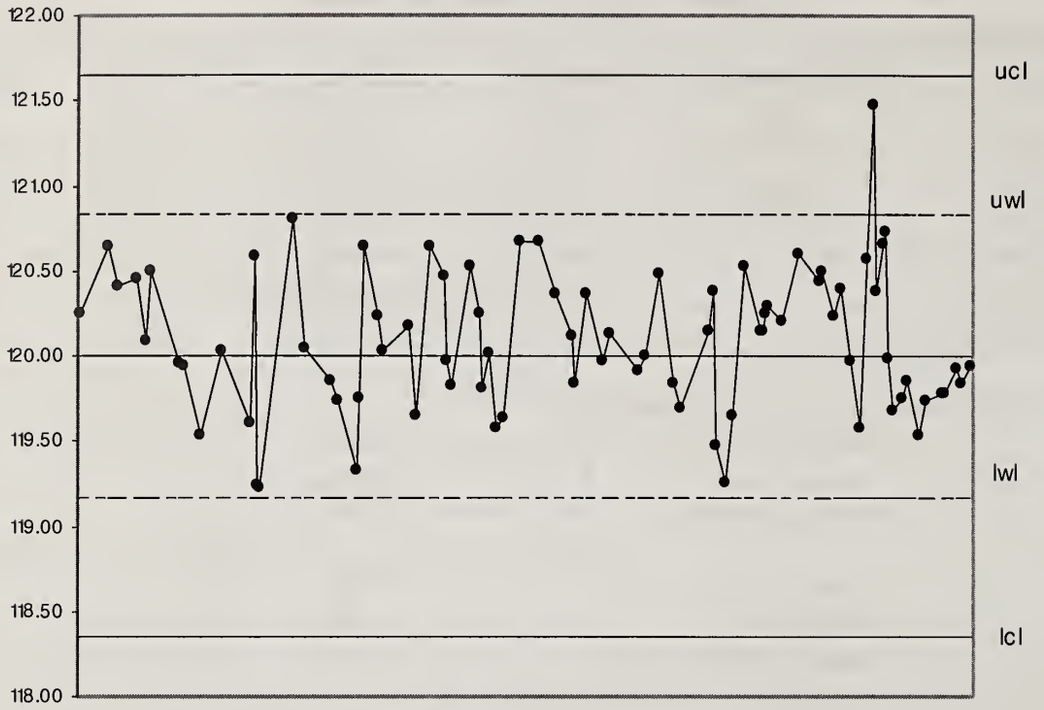
Duplicates

Number	Concentration	Std. Dev.	% Coeff of Var
31	0.0 - 10.0	0.076	1.450
41	10.1 - 20.0	0.182	1.198
117	20.1 - 50.0	0.342	1.109
39	50.1 - 100.0	0.486	0.763
228	Total	0.327	1.085

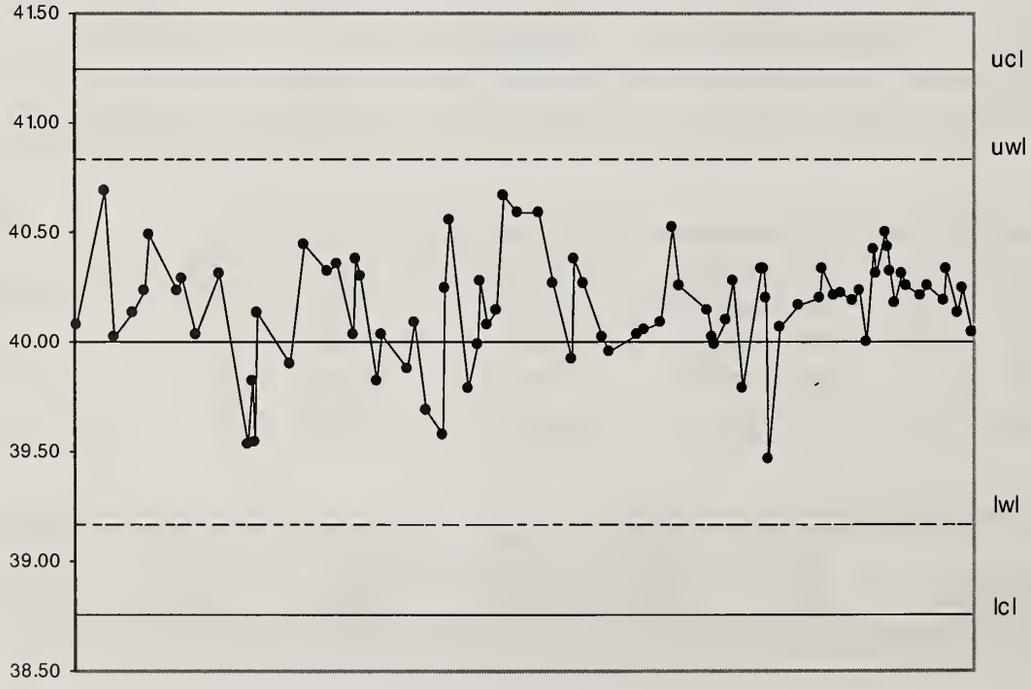
Recoveries

	Number	Expected	Mean	Mean Bias	Std. Dev.	Control Limits
Check Std 1	82	7.000	7.952	0.952	0.109	7.770- 8.230
Check Std 2	82	70.000	75.867	5.867	0.749	71.685 – 78.315

Sulphate SO_4^{-2} (E3172)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 100.00 mg/L as SO_4^{-2}

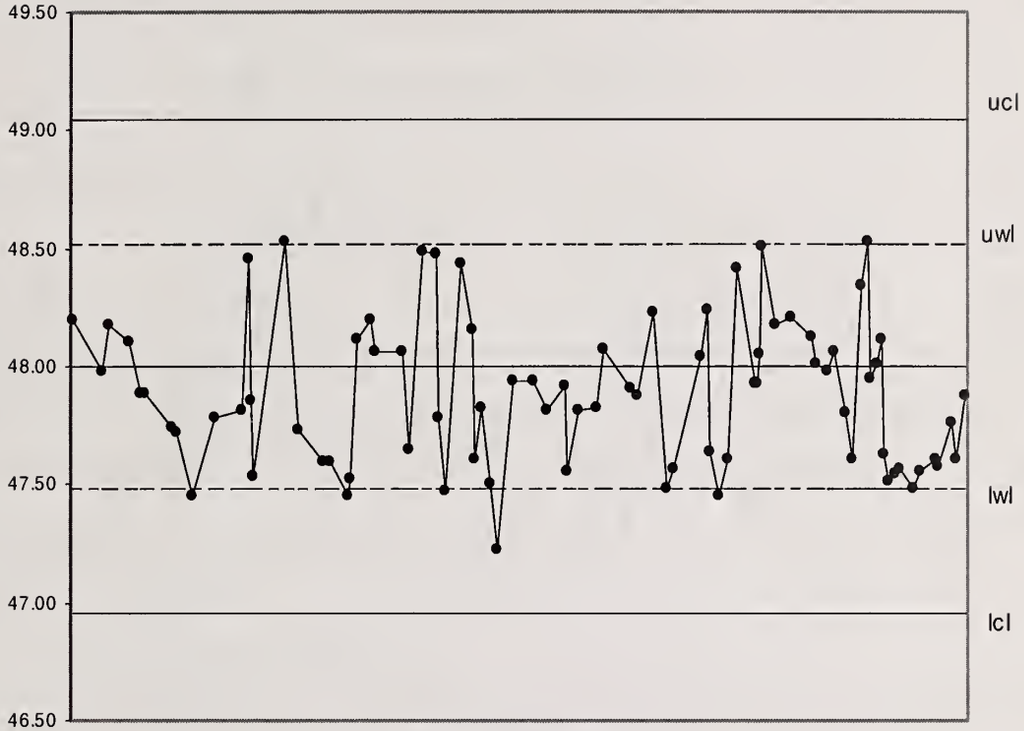


Quality Control Standard A+B

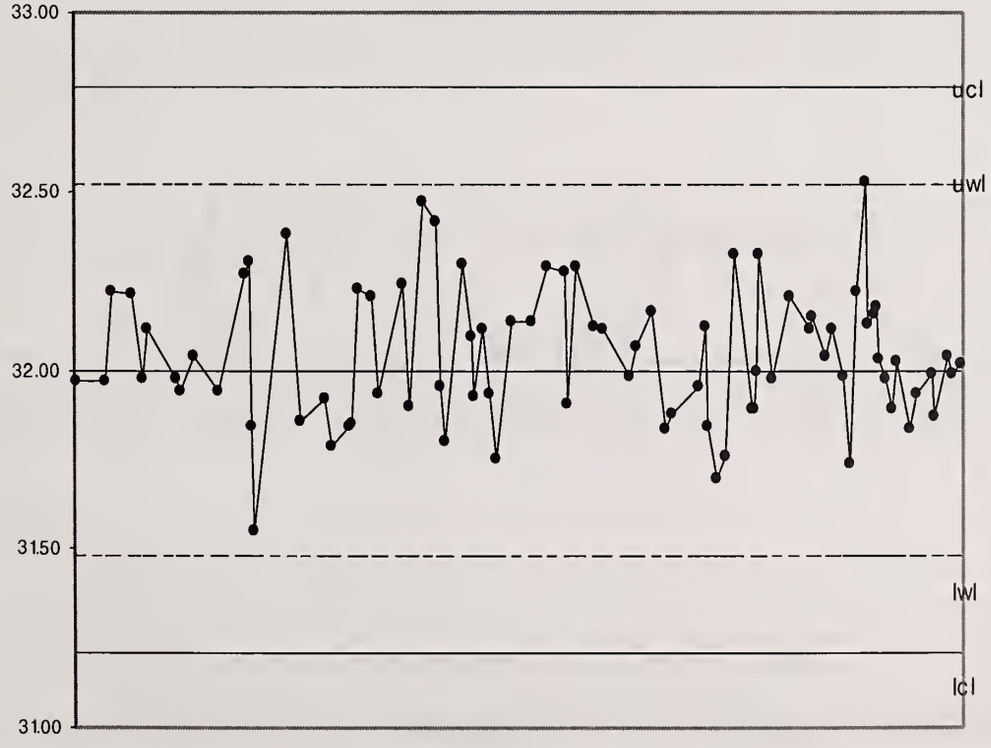


Quality Control Standard A- B

Sulphate SO_4^{-2} (E3172)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 100.00 mg/L as SO_4^{-2}

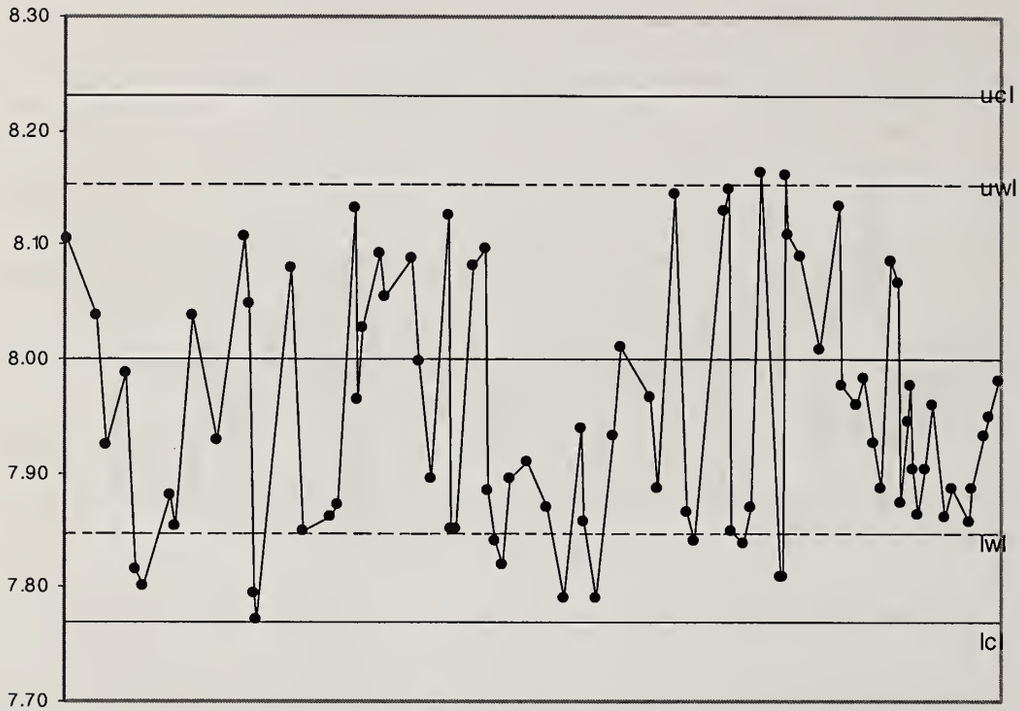


Quality Control Standard B+C

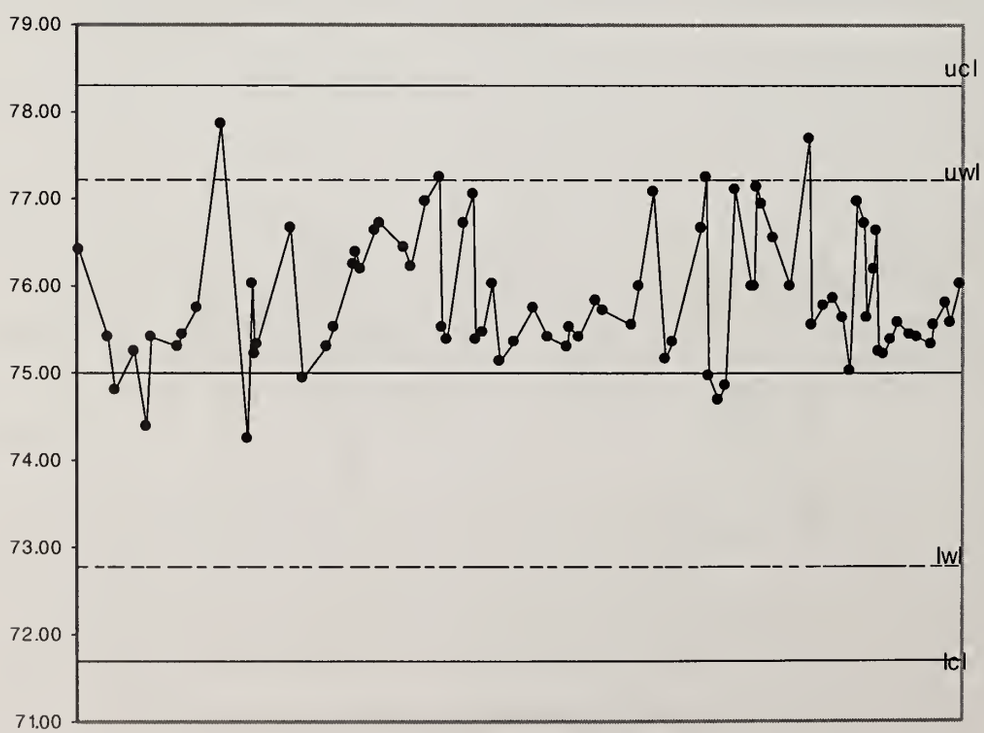


Quality Control Standard B- C

Sulphate SO_4^{-2} (E3172)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 100.00 mg/L as SO_4^{-2}



CS1



CS2

SULPHIDE

ACCREDITATION & DRINKING-WATER LICENSING STATUS

ACCREDITED ☑	Licensed (Drinking Water) ☑
	Drinking Water Standard (SDWA): N/A

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	June 89
Method Reference No.	E3100	Reporting Unit	µg/L as S^{2-}
LIMS Product Code	H2S3100	Supervisor	P.Wilson
Sample Type/Matrix	Drinking Water, Surface Water, Ground Water, Leachates, Effluent, Industrial Waste, Raw Sewage		

SAMPLING:

Quantity Required	50 mL
Container	Glass or plastic
Preservative(s)	None

ANALYTICAL PROCEDURE:

Total Sulphide including; H_2S, HS^- and any acid soluble metal sulphides which have been precipitated as ZnS during sample preservation. The precipitated sulphides (hydrogen sulphides) are dissolved in an alkaline absorbing solution and reacted with N,N-dimethyl-p-phenylenediamine dihydrochloride and ferric chloride to form methylene blue. The intensity of the methylene blue is compared to standards treated in the same manner.

INSTRUMENTATION:

Basic automated modular continuous flow colourimetric system, measurement through a 660 nm filter and a 50 mm flow cell (1.5mm ID).

REPORTING:

Max. Significant Figures: 3	Current W value: 2.0 µg/L	Current T value: 10.0 µg/L	Full Scale: 160.0 µg/L

CALIBRATION:

BL plus 5 standards

CONTROLS:

Calibration	Daily blank and 3 standards, e.g. QCA, QCB, QCC
Drift	Blank and sensitivity check standard approximately every 10 samples

Sulphide (E3100)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 160.0 µg/L as S

Calibration Control

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	14	128	118.164	-9.836	7.41
B	14	80	80.686	0.686	3.2
C	14	32	35.871	3.871	3.635
A + B		208	198.85	-9.15	9.538
A - B		48	37.479	-10.521	6.271
B + C		112	116.557	4.557	5.134
B - C		48	44.814	-3.186	4.533

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	5.708
	Within Runs	4.434
	Between/Within	1.287
s.d.(BC)	Between Runs	3.425
	Within Runs	3.205
	Between/Within	1.069

Control Limits

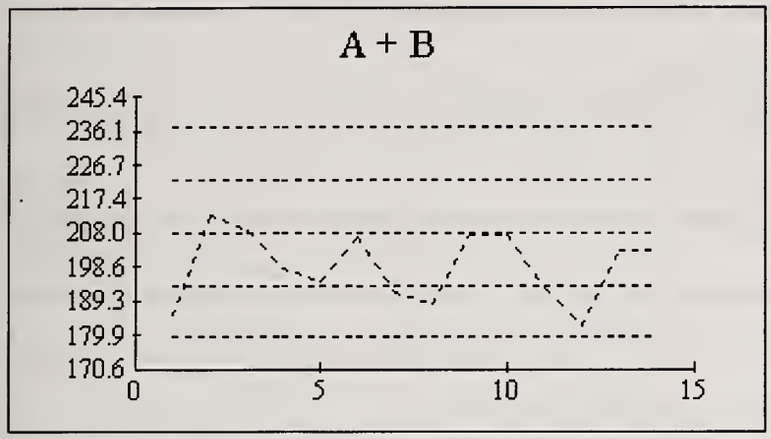
Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	224.40	191.60	236.80	179.20
A - B	64.40	31.60	69.90	26.40
B + C	136.85	87.15	161.70	62.30
B - C	72.85	23.15	85.30	10.70

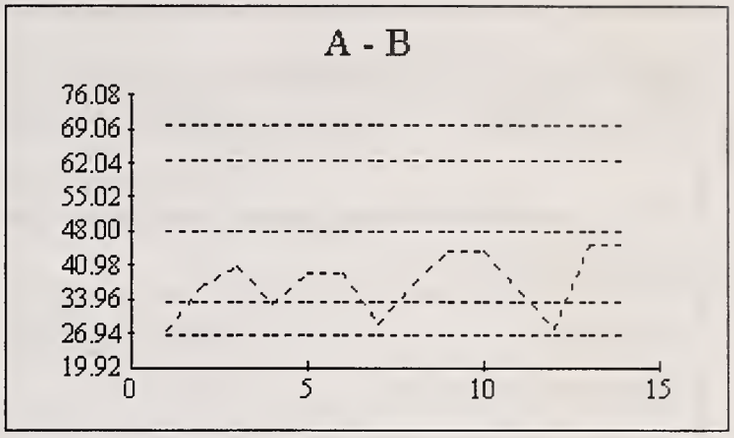
Duplicates

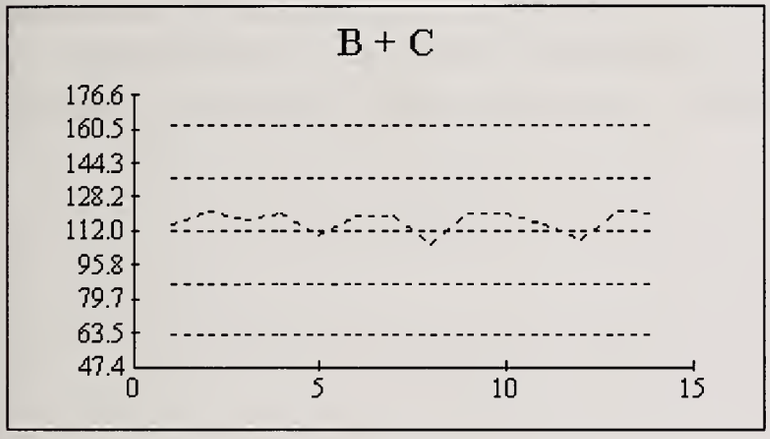
Number	Concentration	Std. Dev.	% Coeff of Var
22	0 - 10%	2.669	66.273
5	10 - 20%	1.878	8.005
2	20 - 50%	NA	NA
1	50 - 100%	NA	NA
30	Total	2.684	20.45

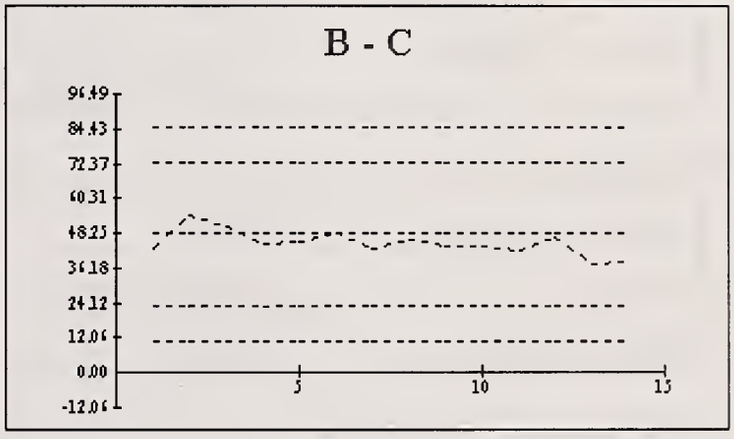
Sulphide **(E3100)**

QC Data; 1/1/2008 to 12/31/2008









TURBIDITY

ACCREDITATION & DRINKING-WATER LICENSING STATUS

ACCREDITED ☑	Licensed (Drinking Water) ☑
	Drinking Water Standard (SDWA): N/A

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	Before'74
Method Reference No.	E3311	Reporting Unit	FTU
LIMS Product Code	TURB3311	Supervisor	P. Wilson
Sample Type/Matrix	Surface Water, Ground Water, Effluent, Drinking Water, Industrial Waste, Process Water, Leachate		

SAMPLING:

Quantity Required:	50 mL
Container:	Glass or plastic
Preservative(s)	None

ANALYTICAL PROCEDURE:

The instrument is standardized with sealed standards which are prepared commercially and are rated in Formazin Turbidity Units. Samples are placed in the turbidimeter, and results in FTU are read directly from the digital output. Turbidity measurements are based on light scattering at 90° (±30°) rotation. The instrument compensates for sample colour.

INSTRUMENTATION:

Hach Ratio/XR Model Turbidimeter modified to accept control signals from robot controller, electronic interface, Zymark ZYMATE 11 Laboratory Robot System and computer.

REPORTING:

Max. Significant Figures: 3	Current W value: 0.05	Current T value: 0.25	Full Scale: 2000 FTU

CALIBRATION:

BL plus formazin standards (once every four months). Calculated QC limits are specific to each standard set.

TURBIDITY cont'd

ONTROLS:

Calibration:	5 standards, e.g. QCA, QCB, QCC, QCD

OTES:

QCA and QCD data for June 4th and 18th are outside the limits respectively. Samples were repeated in heir respective range.

Turbidity (E3311)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 2000.0 FTU

Calibration Control

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	159	2.0	1.700	-0.300	0.066
B	159	20.0	17.618	-2.382	0.187
C	159	200.0	155.080	-44.920	2.851
D	159	2000.0	1604.277	-395.723	10.995
A+B		22.0	19.318	-2.682	0.253
A-B		18.0	15.917	-2.083	0.121
B+C		220.0	172.697	-47.303	3.038
B-C		180.0	137.462	-42.538	2.664
C+D		2200.0	1759.357	-440.643	13.846
C-D		1800.0	1449.197	-350.803	8.144

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.140
	Within Runs	0.179
	Between/Within	0.782
s.d.(BC)	Between Runs	2.020
	Within Runs	2.148
	Between/Within	0.940
s.d.(CD)	Between Runs	8.032
	Within Runs	9.791
	Between/Within	0.820

Duplicates

Number	Concentration	Std. Dev.	% Coeff of Var
142	0.0 - 2.0	0.073	7.565
240	2.1 - 20.0	0.452	4.926
189	21.0 - 200	1.734	2.473
34	201 - 2000	14.079	2.034
605	Total	3.487	5.393

Other Checks

	Number	Expected	Mean	Mean Bias	Std. Dev.
Stray Light	159	0.000	0.073	0.073	0.013

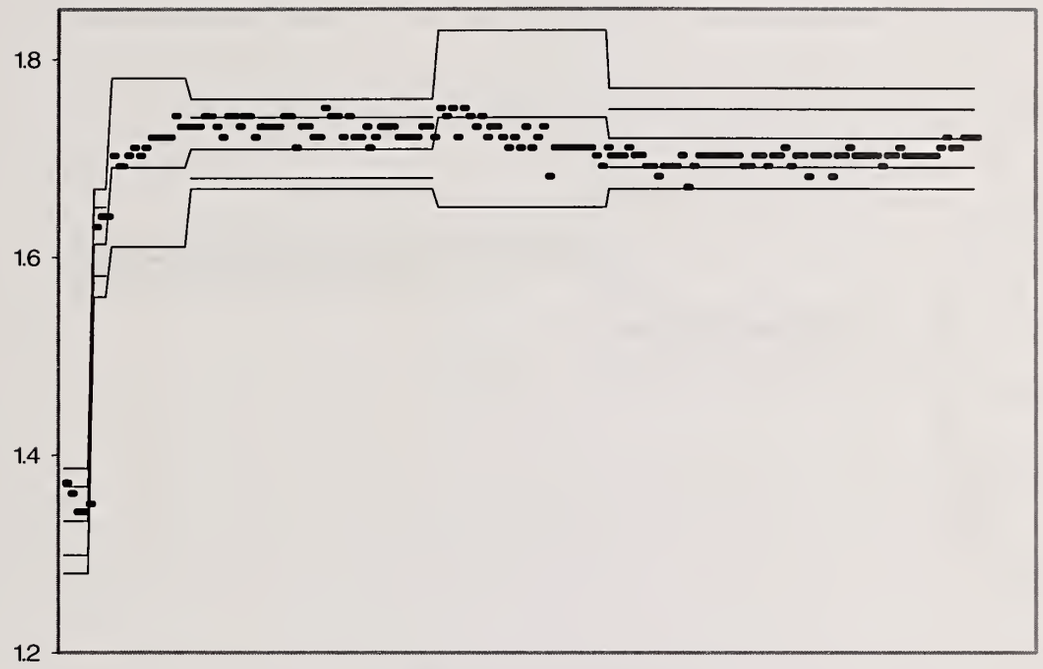
Calibration Control

	2008	Number	Expected Concentration	Mean Concentration	Standard Deviation
A	Jan	5	2.0	1.352	0.013
	Feb	3		1.637	0.006
	Feb - Apr	14		1.713	0.015
	Apr - June	43		1.729	0.009
	June - Aug	30		1.720	0.017
B	Jan	5	20.0	16.82	0.204
	Feb	3		17.00	0.000
	Feb - Apr	14		17.59	0.092
	Apr - June	43		17.63	0.064
	June - Aug	30		17.69	0.061
C	Jan	5	200.0	143.9	0.643
	Feb	3		155.0	0.000
	Feb - Apr	14		152.4	0.646
	Apr - June	43		153.0	0.344
	June - Aug	30		157.1	0.403
D	Jan	5	2000.0	1583	1.140
	Feb	3		1571	0.577
	Feb - Apr	14		1596	2.128
	Apr - June	43		1594	1.730
	June - Aug	30		1606	4.105

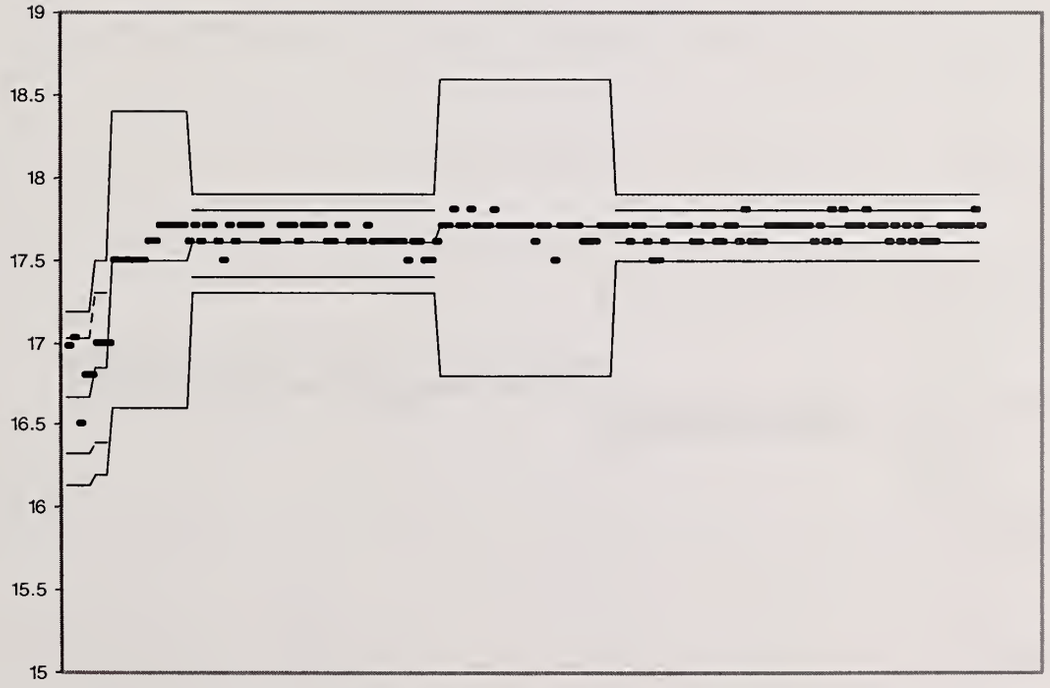
On any given day the calibration is accepted if the values obtained lie within the ranges:

1.28 - 1.39	for	A (Jan)
1.56 - 1.65		A (Feb)
1.61 - 1.78		A (Feb - Apr)
1.67 - 1.76		A (Apr - June)
1.65 - 1.83		A (June - Aug)
1.67 - 1.77		A (Aug - Dec)
16.3 - 17.2		B (Jan)
16.2 - 17.5		B (Feb)
16.6 - 18.4		B (Feb - Apr)
17.3 - 17.9		B (Apr - June)
16.8 - 18.6		B (June - Aug)
17.5 - 17.9		B (Aug - Dec)
142.1 - 146.1		C (Jan)
152 - 159		C (Feb)
144 - 160		C (Feb - Apr)
150.8 - 154.2		C (Apr - June)
150 - 165		C (June - Aug)
155.9 - 158.3		C (Aug - Dec)
1560 - 1591		D (Jan)
1555 - 1577		D (Feb)
1518 - 1677		D (Feb - Apr)
1590 - 1603		D (Apr - June)
1537 - 1698		D (June - Aug)
1599 - 1624		D (Aug - Dec)

Turbidity (E3311)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 2000.0 FTU

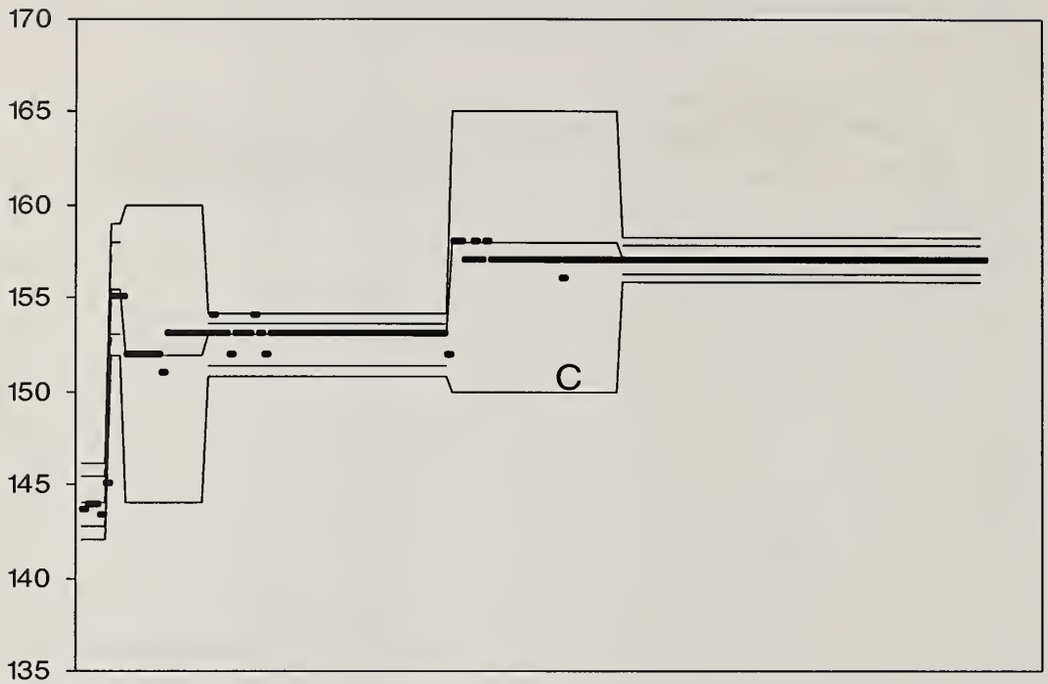


Quality Control Standard A

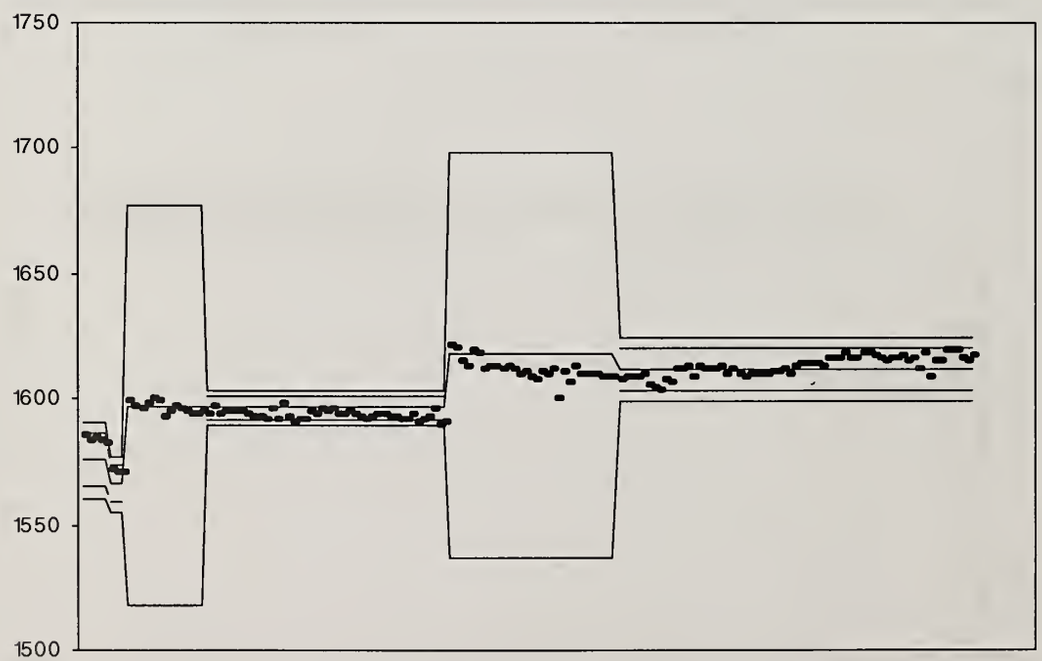


Quality Control Standard B

Turbidity (E3311)
Quality Control Data
2008/1/1 to 2008/12/31
Analytical Range: to 2000.0 FTU



Quality Control Standard C



Quality Control Standard D

PART 3.0
MICROBIOLOGY

3.1 Quality Control Program, Microbiology Unit

Performance Criteria

Analyses of samples in the Microbiology Unit are performed using validated and accredited () methodologies, by trained technologists. Quality control measures have been incorporated into the methodologies to ensure that all analytical procedures are functioning properly, minimizing the potential to identify and report false positive or negative results. This report focuses on the quality control implemented during sample analyses. Information regarding the implementation of quality control procedures for sample containers, monitoring of the Pure Water supply, media preparation and storage, equipment monitoring are described by the Laboratory Services Branch (4) and Microbiology Unit Standard Operating Procedures (SOPs), approved Microbiology Methods and Lab Services Branch Quality Assurance Manual (2).

Membrane Filtration

Blank Control Analyses

A control (sterile buffered dilution water) sample is processed between each sample analyzed. The control sample is processed in a manner similar to the regular sample including volume, agar used, incubation time and temperature. The blank control should remain free of any bacterial growth.

Duplicate Analyses

At least one sample in 10 is analyzed in duplicate per day. The data is accumulated for each parameter and a "within-run" standard deviation is calculated to give a measure of the repeatability of the results.

Presence-Absence Procedure

Blank Control Analyses

At least one sample in 10 samples per day includes a blank control sample prepared by adding a 99 mL dilution blank (sterile, buffered dilution water) to P-A broth and incubating it along with the regular P-A bottles. The blank control should remain free of any bacterial growth and there should be no change in the colour of the broth. Identification of growth or colour change in the control blank requires follow-up of sterility checks in both the P-A broth and the dilution blanks.

Heterotrophic Spread Plate

Blank Control Analyses

At least one sample in 10 samples is analyzed per day includes inoculating a Plate Count agar plate with 0.1 mL of sterile buffered dilution water and incubating it along with the regular Plate Count agar plates (36±0.5°C, 48±3 hours).

Duplicate Analyses

At least one sample in 10 samples is analyzed in duplicate per day. The data is accumulated for each parameter and a "within-run" standard deviation is calculated to give a measure of the repeatability of the results.

Blank Analyses Corrective Action

The presence of bacterial growth on any control sample by the above techniques (Membrane Filtration, PA Broth, Heterotrophic Spread Plate) indicates inaccurate technique. The supervisor must be consulted with regards to determining follow-up and corrective action. Reporting of results may be tempered by the presence of bacterial growth on these control samples and data qualifying remarks codes would be noted on the final report. Records of all control samples are maintained in the laboratory.

3.2 PERFORMANCE SUMMARIES

MICROBIOLOGY

Bacillus thuringiensis israelensis (*Bti*)

ACCREDITATION & DRINKING-WATER LICENSING STATUS

SCC	NO	Licensed (Drinking Water)	NO
CAEAL	NO	Reportable Limit (OSDWA): N/A	

IDENTIFICATION:

Laboratory	Microbiology	Method Introduced	2004
Method Reference No.	E3451	Reporting Unit	CFU/100 mL
LIMS Product Code	BTI3451	Scientist	A. Irwin Abbey & S. Weir
Sample Type/Matrix	Drinking Water		

SAMPLING:

Quantity Required:	250mL
Container:	Bacti bottles
Preservative:	sodium thiosulphate

ANALYTICAL PROCEDURE:

A 100 mL volume from each sample is filtered through a 0.45 μm pore size, cellulose filter. The membrane filter is then placed onto Brain Heart Infusion (BFI) agar plate and incubated 28.5±0.5°C, for 20±3 hours. Target colonies (clear) formed on the membrane filter are aseptically transferred to 100 μL of molecular water where they are boiled at 100.0 ± 5°C for 10 ± 3 minutes followed by centrifugation at 10,000xg for 10 minutes. A 1 μL volume of this supernatant is added to 24 μL master mix and these mixtures are then run in a polymerase chain reaction (PCR). Colonies exhibiting positive results through PCR are confirmed using gel electrophoresis.

INSTRUMENTATION:

ABI Prism® 7900HT Sequence Detection System, biological safety cabinet, bunsen burner, centrifuges, centrifuge tubes (sterile), DNA preparation hood, filtration assembly, freezers and refrigerators, graduated cylinders (sterile), heatblock, incubators, loop, membrane filters (sterile), microscope, microwave, 96 well optical reaction plates, PCR mix preparation hood, pipetting devices, pipetting tips, thermocycler, vortex.

REPORTING:

Max. Significant Figures: 2	Current W value: 0	Current T value: N/A	Full Scale: CFU/100mL

Bacillus thuringiensis israelensis (*Bti*) cont'd

CONTROLS:

Analytical	Duplicate samples Blank filter between samples Negative and positive control samples with each PCR and gel electrophoresis run

Bacillus thuringiensis israelensis (*Bti*) (E3451)
QUALITY CONTROL DATA (2006-2008)
Analytical Range: CFU/100 mL

Membrane Filtration Analyst Duplicates

Counts per plate	Mean (data)	Mean Difference	n (duplicate pairs)	Sdv (duplicates)	Coefficient of Variation
all data	8.40	3.17	35.00	3.05	4.33
0-10	6.03	2.69	26.00	2.40	6.61
11-20	15.92	4.56	9.00	4.43	1.75

Membrane Filtration Method Duplicates

Counts per plate	Mean (data)	Mean Difference	n (duplicate pairs)	Sdv (duplicates)	Coefficient of Variation
all data	10.03	6.60	166.00	6.51	6.47
0-10	8.70	7.10	133.00	6.86	9.07
10-20	15.39	4.61	33.00	4.83	2.04

Polymerase Chain Reaction Analyst Duplicates

Ct	Mean (data)	Mean Difference	n (duplicate pairs)	Sdv (duplicates)	Coefficient of Variation
all data	27.14	0.91	95.00	1.33	0.18
< 20	16.91	0.17	12.00	0.18	0.06
20-30	26.89	1.05	59.00	1.57	0.22
> 30	33.40	0.93	24.00	0.96	0.09

Polymerase Chain Reaction Method Duplicates

Ct	Mean (data)	Mean Difference	n (duplicate pairs)	Sdv (duplicates)	Coefficient of Variation
all data	27.18	2.39	1199.00	2.78	0.38
<20	17.13	1.29	221.00	1.52	0.52
20-30	27.54	2.84	864.00	3.16	0.42
>30	32.51	1.08	114.00	1.01	0.10

Bacillus thuringiensis israelensis (*Bti*)

ACCREDITATION & DRINKING-WATER LICENSING STATUS

SCC	NO	Licensed (Drinking Water): No
CAEAL	NO	Reportable Limit (OSDWA): N/A

IDENTIFICATION:

Laboratory	Microbiology	Method Introduced	*2004*
Method Reference No.	E3452	Reporting Unit	*Total Bti* / 100 mL
LIMS Product Code	BTI3452	Scientist	S. Weir & A. Irwin Abbey
Sample Type/Matrix	Drinking Water (WD), Surface Water (WS), or Ground Water (WG)		

SAMPLING:

Quantity Required:	250mL
Container:	Bacti bottles
Preservative:	none required (may contain sodium thiosulphate)

ANALYTICAL PROCEDURE:

A 100 mL volume from each sample is filtered through a 0.45 μm pore size, cellulose filter, and aseptically removed from the filtration apparatus. DNA is directly extracted from this filter. A 10 μL volume of this DNA extract is added to 15 μL of Master Mix and 1 μL of an internal plasmid. These mixtures are then run using Real-time polymerase chain reaction (PCR) to determine if there are any inhibitors present in the sample that would hinder amplification. If there are inhibitors, the DNA extracts undergo dilution and, if necessary, a purification step and the above is repeated. If no inhibition is present, a 10 μL volume of the DNA extract is added to 15 μL of Master Mix and mixtures are run using Real-time PCR. Samples are quantified using a standard curve of calibrated plasmids that are run concurrently.

INSTRUMENTATION:

Filtration assembly, sterile membrane filters, sterile graduated cylinders, bunsen burner, microscope, biological safety cabinet, ABI Prism 7900HT Sequence Detection System, centrifuges, PCR mix preparation hood, DNA preparation hood, thermocycler, vortex, sterile centrifuge tubes, 96 well optical reaction plates, pipetting devices, pipetting tips, freezers and refrigerators.

REPORTING:

Max. Significant Figures: 2	Current W value: 0	Current T value: N/A	Full Scale: 100 mL

CONTROLS:

Analytical	Duplicate samples Blank filter between samples Negative and positive control samples with each PCR

***Bacillus thuringiensis israelensis* (*Bti*) (E3452)**
Analytical Range: **Total *Bti* / 100 mL**
QUALITY CONTROL DATA FOR 2004-2008

Within-Analyst data for spiked superQ water samples

Quantity per 100mL	Mean D	n (duplicate pairs)	Sdv (dups)	Mean (data) (log)	Coefficient of Variation
all data	0.25	31	0.26	2.96	8.76

Within-Analyst data for raw water samples

Quantity per 100mL	Mean D	n (duplicate pairs)	Sdv (dups)	Mean (data) (log)	Coefficient of Variation
all data	0.26	15	0.27	3.35	7.93

Between-Analyst data for spiked superQ water samples

Quantity per 100mL	Mean D	n (duplicate pairs)	Sdv (dups)	Mean (data) (log)	Coefficient of Variation
all data	0.35	24	0.38	3.91	9.62

Between-Analyst for raw water samples

Quantity per 100mL	Mean D	n (duplicate pairs)	Sdv (dups)	Mean (data) (log)	Coefficient of Variation
all data	0.32	25	0.27	3.51	7.77

Clostridium perfringens (CP)

ACCREDITATION & DRINKING-WATER LICENSING STATUS

SCC	NO	Licensed (Drinking Water)	NO
CAEAL	NO	Reportable Limit (OSDWA): N/A	

IDENTIFICATION:

Laboratory	Microbiology	Method Introduced	2008
Method Reference No.	E3453	Reporting Unit	CFU/1g dry weight
LIMS Product Code	CLOST3453	Scientist	A. Irwin Abbey & S. Weir
Sample Type/Matrix	Sediment (SE), sludge (SL), soil (SO), liquid effluent (TE), industrial/trade waste (TI), process water (TP), raw sewage (TR) and biosolids.		

SAMPLING:

Quantity Required:	250mL or 50g
Container:	Bacti bottles or sterile Whirl-Pak™ bags in a PET500 bottle
Preservative:	sodium thiosulphate for liquids

ANALYTICAL PROCEDURE:

An 11g weight from each sample is aseptically added to 99mL buffer in to a Whirl-Pak bag™. The mixture is homogenized in a BagMixer™ for 2 min, decanted into plastic cups and stored at 4.0 ± 3°C. A volume of 12 to 25 mL of the supernatant is transferred to sterile bottles, heat treated for 20 min at 70.0 ± 2.0°C, and dilutions are filtered through a 0.45 μm pore size, cellulose filter. The membrane filter is placed onto a Tryptose-Sulfite-Cycloserine with D-cycloserine (TSC-D-cycloserine) agar plate. An overlay of TSC-D-cycloserine is placed over the membrane, and the plate is incubated anaerobically at 36.0±1.0°C, for 24±2 hours. Five of the target colonies (black) from each membrane filter are aseptically transferred to Brain Hearth Infusion (BHI) agar plates and incubated anaerobically at 36.0±1.0°C, for 24±2 hours. Colonies are aseptically transferred to 100 μL of molecular water where they are boiled at 100.0 ± 5°C for 10 ± 3 minutes followed by centrifugation at 10,000xg for 10 minutes. A 23 μL volume Master Mix is added to 2.0 μL of this supernatant and these mixtures are then run in a Real-Time Polymerase Chain Reaction (PCR) for confirmation.

PCR INSTRUMENTATION:

ABI Prism® 7900HT Sequence Detection System, biological safety cabinet, bunsen burner, centrifuges, centrifuge tubes (sterile), DNA preparation hood, filtration assembly, freezers and refrigerators, graduated cylinders (sterile), heatblock, incubators, loop, membrane filters (sterile), microscope, microwave, 96 well optical reaction plates, PCR mix preparation hood, pipetting devices, pipetting tips, thermocycler, vortex.

PCR REPORTING:

Max. Significant Figures: 2	Current W value: 0	Current T value: N/A	Full Scale: CFU/100mL

Clostridium perfringens (*CP*) cont'd

PCR CONTROLS:

Analytical	Duplicate samples Negative and positive control samples with each PCR and gel electrophoresis run

Clostridium perfringens (*CP*) (E3453)
PCR QUALITY CONTROL DATA (2008)

Polymerase Chain Reaction Analyst Duplicates

Ct	Mean (data)	Mean Difference	n (duplicate pairs)	Sdv (duplicates)	Coefficient of Variation
all data	19.41	0.22	52.00	0.27	0.07
< 20	18.36	0.13	37.00	0.12	0.03
>20	21.99	0.45	15.00	0.47	0.10

ACCREDITED	NO	Licensed (Drinking Water)	NO

Clostridium perfringens (PC)

Drinking Water Standard (SDWA): NO

IDENTIFICATION:

Laboratory	Microbiology	Method Introduced	2006
Method Reference No.	E3453	Reporting Unit	CFU per g dry weight
LIMS Product Code	CLOST3453	Scientist	R. Schop
Sample Type/Matrix	Sediment (SE), sludge (SL), soil (SO), liquid effluent (TE), industrial/trade waste (TI), process water (TP), raw sewage (TR) and biosolids.		

SAMPLING:

Quantity Required:	250 mL or 50g
Container:	Plastic, ring sealed, sterile Whirl-Pak™ bags in a PET500 bottle
Preservative:	Sodium thiosulphate

ANALYTICAL PROCEDURE:

Sample aliquots are passed through a 0.45 µm pore size, cellulose filter. The membrane filter is then placed onto TSC agar plate with D-cycloserine An overlay of TSC-D-cycloserine is placed over the membrane, and the plate is incubated anaerobically at 36± 1.0°C, 24±2 hours. Target colonies formed on the membrane filter are recorded per 100 mL of sample.

INSTRUMENTATION:

Filtration assembly, sterile membrane filters, sterile graduated cylinders, Bunsen burner, incubator, microscope, Quebec colony counter, anaerobic jars, anaerobic generating systems and anaerobic indicator systems, stomacher, water bath

REPORTING:

Maximum Significant Figures: 2	Current W value: 0	Current T value: Not Applicable

CONTROLS:

Analytical	Duplicate samples Blank filter between samples

E3453
QUALITY CONTROL DATA FOR 2008
CFU/100 mL

DUPLICATES:

n Data Pairs	Counts per Plate	Mean Difference	Standard Deviation (2)	Coefficient of Variation (%)
30	0-19*	1.50	1.50	31.14
17	20-80	3.94	3.26	3.94
1	81-150	2.00	1.41	2.00

*2 duplicates pairs with counts per filter of zero on each.

OTHER CHECKS:

	n	number of blanks with growth
Control Blanks	85	0

Cryptosporidium parvum and *Cryptosporidium hominis*

ACCREDITATION & DRINKING-WATER LICENSING STATUS

SCC	YES	Licensed (Drinking Water) N/A
CAEAL	NO	Reportable Limit (OSDWA): N/A

IDENTIFICATION:

Laboratory	Microbiology	Method Introduced	2006
Method Reference No.	E3463	Reporting Unit	Total *Cryptosporidium* / 100 mL
LIMS Product Code	CRYPTO3463	Scientist	S. Weir
Sample Type/Matrix	Trade Effluent (TE), used for abattoir samples		

SAMPLING:

Quantity Required:	250mL
Container:	Bacti bottles
Preservative:	none required (may contain sodium thiosulphate)

ANALYTICAL PROCEDURE:

A 100 mL volume from each sample is aseptically transferred to a tissue culture tube and centrifuged for 30 min. The sample is decanted, resuspended into water and transferred into an L10 tube. *Cryptosporidium* is extracted from the sample using immunomagnetic separation (IMS). DNA is directly extracted and purified using a liquid nitrogen freeze thaw procedure followed by a QIAGEN QIAvac24 kit. A 10 μL volume of this DNA extract is added to 15 μL of master mix and 1 μL of an internal plasmid probe. These mixtures are then run using Real-time polymerase chain reaction (PCR) to determine if there are any inhibitors present in the sample that would hinder amplification. If there are inhibitors, the DNA extracts undergo dilution and, if necessary, a purification step and the above are repeated. If no inhibition is present, a 10 μL volume of the DNA extract is added to 15 μL of master mix and samples are run using Real-time PCR. Samples are quantified using a standard curve of calibrated plasmids that are run concurrently.

INSTRUMENTATION:

ABI Prism®7900HT Sequence Detection System, bunsen burner, biological safety cabinet, centrifuges, centrifuge tubes (sterile), culture tubes (sterile), DNA preparation hood, Dynal biotech sample mixer, freezers and refrigerators, graduated cylinders (sterile), liquid nitrogen bath, 96 well optical reaction plates, PCR mix preparation hood, pipetting devices, pipetting tips, QIAvac vacuum24 manifold and luer caps, thermocycler, vortex, waterbath.

REPORTING:

Max. Significant Figures: 2	Current W value: 0	Current T value: N/A	Full Scale: 100 mL

CONTROLS:

Analytical	Duplicate samples Blank filter between samples Negative and positive control samples with each PCR

Cryptosporidium parvum and *Cryptosporidium hominis*
E3463
QUALITY CONTROL DATA (2006-2008)
Total *Cryptosporidium*/100mL

Method Duplicates:

	Quantity/100 mL	Mean Difference	n (duplicate pairs)	Sdv (duplicates)	Mean Data (log)	Coefficient of Variation
Abattoir Water	all data	0.22	18.00	0.19	3.32	1.68

Analyst Duplicates:

	Quantity/ 100 mL	Mean Difference	n (duplicate pairs)	Sdv (duplicates)	Mean Data (log)	Coefficient of Variation
Abattoir Water	all data	0.15	22.00	0.15	3.24	4.55
	>10,000	0.07	2.00	0.07	4.19	1.56
	1,000 - 9,999	0.10	16.00	0.09	3.53	2.48
	< 999	0.29	6.00	0.24	2.48	9.83
Super Q Water	all data	0.16	17.00	0.18	3.52	5.19
	>10,000	0.15	14.00	0.18	3.73	4.90
	1,000 - 9,999	0.18	10.00	0.21	3.43	6.15
	<999	0.21	3.00	0.18	2.53	7.24

Escherichia coli (EC)

ACCREDITATION & DRINKING-WATER LICENSING STATUS

ACCREDITED ☑	Licensed (Drinking Water) ☑
	Drinking Water Standard (SDWA): ☑

IDENTIFICATION:

Laboratory	Microbiology	Method Introduced	1979
Method Reference No.	E3226	Reporting Unit	Present/Absent per 100 mL
LIMS Product Code	PA3226	Scientist	R. Schop
Sample Type/Matrix	Drinking Water		

SAMPLING:

Quantity Required:	100 mL
Container:	Plastic, ring sealed
Preservative:	Sodium thiosulphate

ANALYTICAL PROCEDURE:

Sample aliquots are added to P-A broth, incubated (36±1.0°C, for up to 48±3 hours) and checked for growth, gas and acid production. A presumptive positive is identified as the detection of gas and acid production within 48 hours of incubation. Following the identification of a presumptive positive, confirmatory tests for Escherichia coli are conducted according to the method.

INSTRUMENTATION:

Micropipette, sterile micropipette tip, sterile graduated cylinder, Bunsen burner, incubators, UV lamp

REPORTING:

Present / Absent per 100 mL

CONTROLS:

Analytical	Negative Control(5% per day) -Sterile buffered dilution water

NOTES:

*PA3226 is used for the detection of EC and TC. Confirmatory testing using ECMug is required.

Escherichia coli (EC)

E3226
QUALITY CONTROL DATA FOR 2008

Present/Absent per 100 mL

OTHER CHECKS:

	n	number of blanks with growth
Control Blanks	329	0

Escherichia coli (EC)

ACCREDITATION & DRINKING-WATER LICENSING STATUS

ACCREDITED ☑	Licensed (Drinking Water) ☑
	Drinking Water Standard (SDWA): ☑

IDENTIFICATION:

Laboratory	Microbiology	Method Introduced	1979
Method Reference No.	E3371	Reporting Unit	CFU per 100 mL
LIMS Product Code	EC3371, *TC**EC**3371,***EC**FS3371 *,**EC**FSPS3371	Scientist	R. Schop
Sample Type/Matrix	Sediment, Sludge, Soil, Effluent, Industrial Waste, Process Water, Raw Sewage, Drinking Water (Raw Water), Ground Water, Leachate, Precipitation, Surface Water		

SAMPLING:

Quantity Required:	100 mL
Container:	Plastic, ring sealed
Preservative:	Sodium thiosulphate

ANALYTICAL PROCEDURE:

Sample aliquots are passed through a 0.45 µm pore size, cellulose filter. The membrane filter is then placed onto MFC-BCIG agar plate and incubated 44.5±0.5°C, 24±2 hours. Target colonies (blue) formed on the membrane filter are recorded per 100 mL of sample.

INSTRUMENTATION:

Filtration assembly, sterile membrane filters, sterile graduated cylinders, sterile pipettes, Bunsen burner, incubators, microscope, Quebec colony counter

REPORTING:

Maximum Significant Figures: 2	Current W value: 0	Current T value: Not Applicable

CONTROLS:

Analytical	Duplicate samples Blank filter between samples

NOTES:

* TCEC3371,*ECFS3371*,ECFSPS3371 are mixed parameter product codes. See individual tests TC,FS,PSA, for details on medium used and incubation

Escherichia coli (EC)

E3371
QUALITY CONTROL DATA FOR 2008

CFU/100 mL

DUPLICATES:

n Data Pairs	Counts per Plate	Mean Difference	Standard Deviation (2)	Coefficient of Variation (%)
337	0-19*	1.45	1.66	24.42
149	20-80	4.66	3.93	9.00
25	81-150	5.92	5.07	4.54

*120 duplicates pairs with counts per filter of zero on each.

OTHER CHECKS:

	n	number of blanks with growth
Control Blanks	3139	0

Escherichia coli (EC)

ACCREDITATION & DRINKING-WATER LICENSING STATUS

ACCREDITED ☑	Licensed (Drinking Water) ☑
	Drinking Water Standard (ODWQS): ☑

IDENTIFICATION:

Laboratory	Microbiology	Method Introduced	1998
Method Reference No.	E3407	Reporting Unit	CFU per 100mL
LIMS Product Code	*TC**EC**3407	Scientist	R. Schop
Sample Type/Matrix	Drinking Water		

SAMPLING:

Quantity Required:	100 mL
Container:	Plastic, ring sealed
Preservative:	Sodium thiosulphate

ANALYTICAL PROCEDURE:

Sample aliquots are passed through a 0.45 µm pore size, cellulose filter. The membrane filter is then placed onto DC agar plate and incubated 36±1.0°C, 24±2 hours. Target colonies formed on the membrane filter are recorded per 100 mL of sample.

INSTRUMENTATION:

Filtration assembly, sterile membrane filters, sterile graduated cylinders, Bunsen burner, incubator, microscope, Quebec colony counter

REPORTING:

Maximum Significant Figures: 2	Current W value: 0	Current T value: Not Applicable

CONTROLS:

Analytical	Duplicate samples Blank filter between samples

NOTES:

*TCEC3407 is a mixed parameter product code. The same medium and incubation time are used to determine both parameters TC and EC.

Escherichia coli (EC)

E3407
QUALITY CONTROL DATA FOR 2008

CFU/100 mL

DUPLICATES:

n Data Pairs	Counts per Plate	Mean Difference	Standard Deviation (2)	Coefficient of Variation (%)
25	0-19*	1.28	1.88	49.37
25	20-80	5.08	4.22	9.29
N.A.	81-150	N.A.	N.A.	N.A.

*15 duplicates pairs with counts per filter of zero each.

OTHER CHECKS:

	n	number of blanks with growth
Control Blanks	184	0

Escherichia coli (EC)

ACCREDITATION & DRINKING-WATER LICENSING STATUS

ACCREDITED ☑	Licensed (Drinking Water) □
	Drinking Water Standard (SDWA): N/A

IDENTIFICATION:

Laboratory	Microbiology	Method Introduced	2004
Method Reference No.	E3433	Reporting Unit	CFU /g wet weight
LIMS Product Code	EC3433	Scientist	R. Schop
Sample Type/Matrix	Sediment, Sludge, Soil, Effluent, Industrial Waste, Process Water, Raw Sewage		

SAMPLING:

Quantity Required:	50g
Container:	WhirlPak™ bag
Preservative:	None

ANALYTICAL PROCEDURE:

Sample aliquots are passed through a 0.45 µm pore size, cellulose filter. The membrane filter is then placed onto MFC-BCIG agar plate and incubated 44.5±0.5°C, 24±2 hours. Target colonies (blue) formed on the membrane filter are recorded per gram wet weight of sample.

INSTRUMENTATION:

Filtration assembly, sterile membrane filters, sterile graduated cylinders, sterile pipettes, Bunsen burner, incubators, microscope, Quebec colony counter

REPORTING:

Maximum Significant Figures: 2	Current W value: 0	Current T value: Not Applicable

CONTROLS:

Analytical	Duplicate samples Blank filter between samples

Escherichia coli (EC)

E3433
QUALITY CONTROL DATA FOR 2008

CFU/100 mL

DUPLICATES:

n Data Pairs	Counts per Plate	Mean Difference	Standard Deviation (2)	Coefficient of Variation (%)
19	0-19	2.47	2.31	27.71
7	20-80	5.71	4.49	9.67
5	81-150	3.00	6.74	5.16

OTHER CHECKS:

	n	number of blanks with growth
Control Blanks	57	0

Fecal Streptococci (FS)

ACCREDITATION & DRINKING-WATER LICENSING STATUS

ACCREDITED ☑	Licensed (Drinking Water) ☑
	Drinking Water Standard (ODWQS): ☑

IDENTIFICATION:

Laboratory	Microbiology	Method Introduced	1979
Method Reference No.	E3371	Reporting Unit	CFU per 100 mL
LIMS Product Code	FS3371,*EC**FS**3371, *EC**FS**PS3371	Scientist	R. Schop
Sample Type/Matrix	Sediment, Sludge, Soil, Effluent, Industrial Waste, Process Water, Raw Sewage, Drinking Water (Raw Water), Ground Water, Leachate, Precipitation, Surface Water		

SAMPLING:

Quantity Required:	100 mL
Container:	Plastic, ring sealed
Preservative:	Sodium thiosulphate

ANALYTICAL PROCEDURE:

Sample aliquots are passed through a 0.45 µm pore size, cellulose filter. The membrane filter is then placed onto mEnterococcus agar plate and incubated 36±1.0°C, 48±3 hours. Target colonies formed on the membrane filter are recorded per 100 mL of sample.

INSTRUMENTATION:

Filtration assembly, sterile membrane filters, sterile graduated cylinders, sterile pipettes, Bunsen burner, incubators, microscope, Quebec colony counter

REPORTING:

Maximum Significant Figures: 2	Current W value: 0	Current T value: Not Applicable

CONTROLS:

Analytical	Duplicate samples Blank filter between samples

NOTES:

ECFS3371, ECFSPS3371 are mixed parameter product codes. See individual tests EC, PSA, for details on medium used and incubation.

Fecal Streptococci (FS)

E3371
QUALITY CONTROL DATA FOR 2008

CFU/100 mL

DUPLICATES:

n Data Pairs	Counts per Plate	Mean Difference	Standard Deviation (2)	Coefficient of Variation (%)
222	0-19*	1.62	1.79	33.49
110	20-80	4.20	3.93	8.80
30	81-150	5.47	5.05	4.40

*62 duplicates pairs with counts per filter of zero on each.

OTHER CHECKS:

	n	number of blanks with growth
Control Blanks	3139	0

Heterotrophic Plate Count (HPC)

ACCREDITATION & DRINKING-WATER LICENSING STATUS

ACCREDITED ☑	Licensed (Drinking Water) ☑
	Drinking Water Standard (ODWQS): ☑

IDENTIFICATION:

Laboratory	Microbiology	Method Introduced	1998
Method Reference No.	E3408	Reporting Unit	CFU per 1mL
LIMS Product Code	PC3408	Scientist	R. Schop
Sample Type/Matrix	Drinking Water, Ground Water, Surface Water		

SAMPLING:

Quantity Required:	100 mL
Container:	Plastic, ring sealed
Preservative:	Sodium thiosulphate

ANALYTICAL PROCEDURE:

Sample aliquot is inoculated onto a Plate Count agar plate with a micropipette. The sample is then spread onto the plate using a glass rod and an electronic turntable. The plate is then incubated 35±0.5°C, 48±3 hours and checked for growth. Target colonies formed on the plate are recorded per 1 mL of sample

INSTRUMENTATION:

Micropipette, sterile micropipette tips, sterile glass rod, electronic turntable, incubator, Quebec colony counter

REPORTING:

Maximum Significant Figures: 2	Current W value: 0	Current T value: Not Applicable

CONTROLS:

Analytical	Duplicates Negative control per run- open air plate Negative control (5% per day) - glass rod check

Heterotrophic Plate Count (HPC)

E3408
QUALITY CONTROL DATA FOR 2008

CFU/mL

DUPLICATES:

n Data Pairs	Counts per Plate	Mean Difference	Standard Deviation (2)	Coefficient of Variation (%)
27	0-19*	1.37	1.94	48.70
10	20-80	3.00	2.65	4.69
1	81-150	1.00	0.71	0.80

*19 duplicates pairs with counts per filter of zero on each.

OTHER CHECKS:

	n	number of blanks with growth
Control Blanks	27	0

INDICATOR ORGANISMS

ACCREDITATION & DRINKING-WATER LICENSING STATUS

ACCREDITED ☑	Licensed (Drinking Water) ☑
	Drinking Water Standard (SDWA): N/A

IDENTIFICATION:

Laboratory	Microbiology	Method Introduced	1979
Method Reference No.	E3226	Reporting Unit	Present/Absent per 100 mL
LIMS Product Code	PA3226	Scientist	R. Schop
Sample Type/Matrix	Drinking Water		

SAMPLING:

Quantity Required:	100 mL
Container:	Plastic, ring sealed
Preservative:	Sodium thiosulphate

ANALYTICAL PROCEDURE:

Sample aliquots are added to P-A broth and incubated (36±1.0°C, for up to 48±3 hours) and checked for growth, gas and acid production. A presumptive positive is identified as the detection of gas and acid production within 48 hours of incubation. Following the identification of a presumptive positive, confirmatory tests for indicator organisms are conducted according to the method.

INSTRUMENTATION:

Micropipette, sterile micropipette tip, sterile graduated cylinder, Bunsen burner, incubators

REPORTING:

Detected/Not Detected per 100 mL

CONTROLS:

Analytical	Negative Control -Sterile buffered dilution water

NOTES:

*PA3226 is used for the detection of indicator organisms. Various media are used in their determinations . See method.

Indicator Organisms

E3226

QUALITY CONTROL DATA FOR 2008

Present/Absent per 100 mL

	n	Number of Confirmed Indicator Organisms
Presumptive Positive	35	3

Pseudomonas aeruginosa (PSA)

ACCREDITATION & DRINKING-WATER LICENSING STATUS

ACCREDITED ☑	Licensed (Drinking Water) ☑
	Drinking Water Standard (SDWA): N/A

IDENTIFICATION:

Laboratory	Microbiology	Method Introduced	1979
Method Reference No.	E3371	Reporting Unit	CFU per 100 mL
LIMS Product Code	PSA3371,*ECFS**PS**3371	Scientist	R. Schop
Sample Type/Matrix	Sediment, Sludge, Soil, Effluent, Industrial Waste, Process Water, Raw Sewage, Drinking Water (Raw Water), Ground Water, Leachate, Precipitation, Surface Water		

SAMPLING:

Quantity Required:	100 mL
Container:	Plastic, ring sealed
Preservative:	Sodium thiosulphate

ANALYTICAL PROCEDURE:

Sample aliquots are passed through a 0.45 µm pore size, cellulose filter. The membrane filter is then placed onto mPA agar plate and incubated 41.5±0.5°C, 48±3 hours. Target colonies formed on the membrane filter are recorded per 100 mL of sample.

INSTRUMENTATION:

Filtration assembly, sterile membrane filters, sterile graduated cylinders, sterile pipettes, Bunsen burner, incubators, microscope, Quebec colony counter

REPORTING:

Maximum Significant Figures: 2	Current W value: 0	Current T value: Not Applicable

CONTROLS:

Analytical	Duplicate samples Blank filter between samples

NOTES:

*ECFSPS3371 is a mixed parameter product code. See individual test EC, FS for details on medium used and incubation.

***Pseudomonas aeruginosa* (PSA)**

E3371
QUALITY CONTROL DATA FOR 2008

CFU/100 mL

DUPLICATES:

n Data Pairs	Counts per Plate	Mean Difference	Standard Deviation (2)	Coefficient of Variation (%)
20	0-19*	1.00	1.38	17.72
11	201-80	3.18	2.88	8.78
1	81-150	3.00	2.12	4.04

* 11 duplicates pairs with counts per filter of zero on each.

OTHER CHECKS:

	n	number of blanks with growth
Control Blanks	162	0

Total Coliforms (TC)

ACCREDITATION & DRINKING-WATER LICENSING STATUS

ACCREDITED ☑	Licensed (Drinking Water) ☑
	Drinking Water Standard (ODWQS): ☑

IDENTIFICATION:

Laboratory	Microbiology	Method Introduced	1979
Method Reference No.	E3226	Reporting Unit	Present/Absent per 100 mL
LIMS Product Code	PA3226	Scientist	R. Schop
Sample Type/Matrix	Drinking Water		

SAMPLING:

Quantity Required:	100 mL
Container:	Plastic, ring sealed
Preservative:	Sodium thiosulphate

ANALYTICAL PROCEDURE:

Sample aliquots are added to P-A broth and incubated (36±1.0°C, for up to 48±3 hours) and checked for growth, gas and acid production. A presumptive positive is identified as the detection of gas and acid production within 48 hours of incubation. Following the identification of a presumptive positive, confirmatory tests for Total Coliforms are conducted according to the method.

INSTRUMENTATION:

Micropipette, sterile micropipette tip, sterile graduated cylinder, Bunsen burner, incubators, UV lamp

REPORTING:

Present / Absent per 100 mL

CONTROLS:

Analytical	Negative Control -Sterile buffered dilution water

NOTES:

*PA3226 is used for the detection of EC and TC. Confirmatory testing using ECMug is required.

Total Coliforms (TC)

E3226
QUALITY CONTROL DATA FOR 2008

Present/Absent per 100 mL

OTHER CHECKS:

	n	number of blanks with growth
Control Blanks	329	0

Total Coliforms (TC)

ACCREDITATION & DRINKING-WATER LICENSING STATUS

ACCREDITED ☑	Licensed (Drinking Water) ☑
	Drinking Water Standard (ODWQS): ☑

IDENTIFICATION:

Laboratory	Microbiology	Method Introduced	1979
Method Reference No.	E3371	Reporting Unit	CFU per 100 mL
LIMS Product Code	TC3371, *TCEC3371	Scientist	R. Schop
Sample Type/Matrix	Sediment, Sludge, Soil, Effluent, Industrial Waste, Process Water, Raw Sewage, Drinking Water (Raw Water), Ground Water, Leachate, Precipitation, Surface Water		

SAMPLING:

Quantity Required:	100 mL
Container:	Plastic, ring sealed
Preservative:	Sodium thiosulphate

ANALYTICAL PROCEDURE:

Sample aliquots are passed through a 0.45 µm pore size, cellulose filter. The membrane filter is then placed onto mEndo LES agar plate and incubated 36±1.0°C, 24±2 hours. Target colonies formed on the membrane filter are recorded per 100 mL of sample.

INSTRUMENTATION:

Filtration assembly, sterile membrane filters, sterile graduated cylinders, sterile pipettes, Bunsen burner, incubators, microscope, Quebec colony counter.

REPORTING:

Maximum Significant Figures: 2	Current W value: 0	Current T value: Not Applicable

CONTROLS:

Analytical	Duplicate samples Blank filter between samples

NOTES:

* TCEC3371 is a mixed parameter product code. See individual test (EC) for details on medium used and incubation.

Total Coliforms (TC)

E3371
QUALITY CONTROL DATA FOR 2008

CFU/100 mL

DUPLICATES:

n Data Pairs	Counts per Plate	Mean Difference	Standard Deviation (2)	Coefficient of Variation (%)
10	0-19*	1.90	2.66	74.79
25	20-80	4.76	4.33	8.68
2	81-150	4.50	4.03	4.57

* 4 duplicates pairs with counts per filter of zero on each.

OTHER CHECKS:

	n	number of blanks with growth
Control Blanks	3139	0

Total Coliforms (TC)

ACCREDITATION & DRINKING-WATER LICENSING STATUS

ACCREDITED ☑	Licensed (Drinking Water) ☑
	Drinking Water Standard (ODWQS): ☑

IDENTIFICATION:

Laboratory	Microbiology	Method Introduced	1998
Method Reference No.	E3407	Reporting Unit	CFU per 100mL
LIMS Product Code	***TC**EC3407	Scientist	R. Schop
Sample Type/Matrix	Drinking Water		

SAMPLING:

Quantity Required:	100 mL
Container:	Plastic, ring sealed
Preservative:	Sodium thiosulphate

ANALYTICAL PROCEDURE:

Sample aliquots are passed through a 0.45 µm pore size, cellulose filter. The membrane filter is then placed onto DC agar plate and incubated 36±1.0°C, 24±2 hours. Target colonies formed on the membrane filter are recorded per 100 mL of sample.

INSTRUMENTATION:

Filtration assembly, sterile membrane filters, sterile graduated cylinders, Bunsen burner, incubator, microscope, Quebec colony counter.

REPORTING:

Maximum Significant Figures: 2	Current W value: 0	Current T value: Not Applicable

CONTROLS:

Analytical	Duplicate samples Blank filter between samples

NOTES:

*TCEC3407 is a mixed parameter product code. The same medium and incubation time are used to determine both parameters TC and EC.

Total Coliforms (TC)

E3407
QUALITY CONTROL DATA FOR 2008

CFU/100 mL

DUPLICATES:

n Data Pairs	Counts per Plate	Mean Difference	Standard Deviation (2)	Coefficient of Variation (%)
23	0-19*	1.00	1.41	51.76
19	20-80	6.00	5.42	10.03
4	81-150	4.25	3.66	4.25

* 13 duplicates pairs with counts per filter of zero on each.

OTHER CHECKS:

	n	number of blanks with growth
Control Blanks	184	0

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ABBREVIATIONS

AAII	- Auto Analyzer Model II
AAS	- Atomic Absorption Spectrophotometer
Bl	- Blank
°C	- Degree Centigrade
cm	- Centimetre
CS1	- Check Sample 1
CS2	- Check Sample 2
CFU	- Colony Forming Units
Date	- Month/Day/Year
DO	- Dissolved Oxygen
EDTA	- Ethylenediaminetetra-Acetic Acid, Disodium Salt, Dihydrate
FTU	- Formazin Turbidity Units
g	- Gram
HZU	- Hazen Units
in^2	- Square Inches
IS(n)	- Internal Standard (n denotes parameter)
kg	- kilogram
L	- Litre
LAB	- Laboratory
LIMS	- Laboratory Information Management System
LTB/L	- Long Term Blank
lcl	- Low Control Limit
lwl	- Low Warning Limit
m^3	- Cubic Metre
M	- Molarity
MB	- Method Blank
meq	- Milliequivalent
mg	- Milligram
min	- Minute
mL	- Millilitre
mm	- Millimetre
N	- Normality
N.A.	- Not Available or Not Applicable
nm	- Nanometre
n	- Number
PC	- Personal Computer

ABBREVIATIONS cont'd

Pure-DW	- Pure Deionized Water
Pure-W	- Pure Water
QC	- Quality Control
QCA	- Quality Control Standard A
QCB	- Quality Control Standard B
QCC	- Quality Control Standard C
QCD	- Quality Control Standard D
R	- Recovery
rpm	- Revolutions Per Minute
RS92	- Reference Standard (in -house)
S	- Between Run Standard Deviation
S_1	- Standard Deviation (Conventional)
S_2	- Standard Deviation For Duplicates
S_w	- Standard Deviation Within Run
S. Class	- Weight Classification Designation (not certified)
s.d.	- Standard Deviation
Standard Cal	- Colourimeter setting to control electronic expansion
STD	- Standard
TCU	- True Colour Units
TPTZ	- Ferrous-2,4,6-tri(2'pyridyl)-1,3,5,- triazine
ucl	- Upper Control Limit
uwl	- Upper Warning Limit
µm	- Micrometer
µeq	- Microequivalent
µg	- Microgram
µS	- Micro-Siemen
UV	- Ultra-Violet
V/V	- Concentration based on volume measurements
W40	- Whatman 40 Filters
%	- Percent

Appendix A
W and T values for '08

Parameter	Method Reference No.	Units	Full Scale	W	T	W estimate (2008)
Alkalinity, Total Fixed Endpoint	(E3218)	mg/L $CaCO_3$	1000	0.5	2.5	0.3
Bromate	(E3434)	µg/L BrO_3	30	0.2	1.0	0.08
Bromide	(E3434)	µg/L Br	300	0.2	1.0	0.5
Carbon, Dissolved Inorganic	(E3370)	mg/L C	80.0	0.2	1.0	0.4
Carbon, Dissolved Organic	(E3370)	mg/L C	20.0	0.1	0.5	0.1
Chloride	(E3004)	µg/m^3 Cl	28.6	0.1	0.5	0.01
Chloride	(E3013)	µg/g Cl	-	0.5	2.5	0.4
Chloride	(E3016)	mg/L Cl	100	0.2	1.0	0.1
Chlorophyll "a"	(E3169)	µg/L	-	0.2	1.0	0.1
Chlorophyll "a" Acidified	(E3169)	µg/L	-	1.0	5.0	0.2
Chlorophyll "b"	(E3169)	µg/L	-	0.1	0.5	0.04
Colour, True	(E3219)	TCU	100	0.2	1.0	0.3
Conductivity	(E3218)	µS/cm	2000	1	5	1
Cyanide, Free	(E3015)	mg/L CN^-	0.2	0.001	0.005	0.0001
		µg/g CN^-		0.01	0.05	-
Cyanide, Total	(E3015)	mg/L CN^-	0.2	0.001	0.005	0.0002
Cyanide, Total	(E3015)	µg/g CN^-		0.01	0.05	-
Fluoride	(E3172)	mg/L F	2.0	0.01	0.05	0.005
Nitrate	(E3004)	µg/m^3 NO_3	28.6	0.1	0.5	0.02
Nitrilotriacetic Acid	(E3406)	mg/L NTA	1.00	0.01	0.05	0.005
Nitrogen, Ammonia Plus Ammonium	(E3364)	mg/L N	2.0	0.002	0.01	0.003

Appendix A
W and T values for '08

Parameter	Method Reference No.	Units	Full Scale	W	T	W estimate (2008)
Ammonia Plus Ammonium	(E3366)	mg/L N	50.0	0.05	0.25	0.04
Nitrogen, Nitrate Plus Nitrite	(E3364)	mg/L N	12.008	0.005	0.025	0.01
Nitrogen, Nitrate Plus Nitrite	(E3366)	mg/L N	50.0	0.05	0.25	0.11
Nitrogen, Nitrite	(E3364)	mg/L N	0.200	0.001	0.005	0.001
Nitrogen, Nitrite	(E3366)	mg/L N	2.00	0.005	0.025	0.003
Nitrogen, Total Kjeldahl	(E3116)	mg/g N	10	0.1	0.5	0.04
Nitrogen, Total Kjeldahl	(E3367)	mg/L N	2.00	0.02	0.10	0.02
Nitrogen, Total Kjeldahl	(E3368)	mg/L N	50.0	0.05	0.25	0.06
Oxygen Demand, Biochemical	(E3182)	mg/L O	9.0	0.2	1	0.06
Oxygen Demand, Chemical	(E3170)	mg/L O	50	1	5	1
Oxygen Demand, Chemical	(E3246)	mg/L O	500	2	10	2
pH	(E3218)	-	-	-	-	
Phenolics, Reactive	(E3179)	µg/L Phenol	50.0	0.2	1.0	0.1
Phosphorus, Reactive ortho-Phosphate	(E3364)	mg/L P	0.100	0.0005	0.0025	0.002
Reactive ortho-Phosphate	(E3366)	mg/L P	10.0	0.02	0.10	0.01
Phosphorus, Total	(E3116)	mg/g P	2	0.02	0.10	0.05
Phosphorus, Total	(E3367)	mg/L P	0.200	0.002	0.01	0.002
Phosphorus, Total	(E3368)	mg/L P	10.0	0.02	0.10	0.05
Silicon, Reactive Silicates	(E3370)	mg/L Si	10.0	0.02	0.10	0.007
Solids, Dissolved	(E3188)	mg/L	-	10	50	7

Appendix A
W and T values for '08

Parameter	Method Reference No.	Units	Full Scale	W	T	W estimate (2008)
Solids, Suspended	(E3188)	mg/L	-	0.5	2.5	0.2
Solids, Suspended Ignited	(E3188)	mg/L	-	0.5	2.5	0.2
Solids, Total	(E3188)	mg/L	-	10.0	50.0	20
Solids, Total Ignited	(E3188)	mg/L	-	10.0	50.0	6.7
Sulphate	(E3004)	$\mu g/m^3$ SO_4	28.6	0.1	0.5	0.01
Sulphate	(E3013)	µg/g	1000	0.5	2.5	1.3
Sulphate	(E3172)	mg/L SO_4	100	0.5	2.5	0.08
Sulphide	(E3100)	µg/L S^{2-}	160	2.0	10.0	2.7
Turbidity	(E3311)	FTU	2000	0.05	0.25	0.07

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